

SHARPSHOOTING AT THE ATOM

POPULAR MECHANICS



MADE IN U.S.A.
WRITTEN BY

REGD. TRADE MARK GREAT BRITAIN No. 410215

REG. U.S. Pat. Off.

JULY
25 CENTS

SEE PAGE 14



I SHOULD THINK
MOTORISTS WOULD
REALIZE THAT A **SKID**
IS THE MOST DANGEROUS
THING ON THE ROAD

I DON'T AGREE! I'VE SEEN
PLENTY OF ACCIDENTS
AND I THINK A
BLOW-OUT IS MUCH WORSE



Why Argue? New Goodrich Tire Protects Against ***BOTH*** Skids and Blow-outs

READING TIME: 56 SECONDS

How would *you* vote on this question: Which are worse—skids or blow-outs? Many motorists say 'skids'—many say 'blow-outs'. When skids and blow-outs kill or injure thousands don't take chances on tires that give you only *half-way* protection.

For safety's sake equip your car now with the new Goodrich Silvertown—the tire that gives you maximum protection against BOTH skids and blow-outs.

★ ★ ★

You can't beat the action of a windshield wiper for sweeping a wet surface dry. And that's the way Silvertown's Life-Saver Tread acts on wet roads! No wonder, then, this new Silvertown will give you the quickest non-skid stops you've ever had!

The Life-Saver Tread on the outside of this tire is safety you can see and

feel. But, remember, "Silvertown Safety" doesn't stop there. It's *inside* the tire, too—in the new, improved *heat-resisting* Golden Ply that gives you greater protection against high-speed blow-outs.

So why argue about skids and blow-outs? You can get Silvertown *today* on the liberal Budget Plan available at Goodrich Silvertown Stores and many Goodrich Dealers.

★ ★ ★

ONLY 10¢ for a miniature reproduction of your own license plate on a key chain! Your own number—your own state colors. Drive in to your nearest Goodrich Dealer or Goodrich Silvertown Store and ask them to get one of these popular and valuable key chains for you. No obligation. Only 10¢ to cover handling cost.



The *new* Goodrich **SAFETY** Silvertown

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RIDE HIGH WIDE AND HANDSOME **WITH NEW** **CHAMPION SPARK PLUGS !**

A NEW SET of Champion Spark Plugs will rejuvenate the lagging performance of any car, and fill you with the urge to get out and "ride high, wide and handsome." For Champions, with their championship qualities, restore lost power, speed and acceleration and increase gas mileage so that in a short time they have saved their small cost.

Champions make every engine a better performing engine. That's why they are the choice of most racing champions everywhere—

on land, water and in the air—and of the majority of motorists the world over.

Sillment is the sensational new material used to seal Champions against gas or compression leakage, at the shoulder and through the center electrode. This exclusive and patented process seals Champions against troublesome leakage common to ordinary spark plugs, and accounts for their better performance in today's high-compression engines. Demand dependable Champions for your car.

MODEL BUILDERS—ATTENTION!

**ACTUAL SIZE
V-PLUG**



65c

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Champion Spark Plugs for model gas engines give the same dependable performance as the regular Champions. Sillment sealed. Sillmanite insulator. Alloy needlepoint electrodes for easy starting. One piece construction.

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Hex	1/2"	3/8"	5/16"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	9/32
Weight, Grams	8	3 1/2	2 1/2

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smoking

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\$45,000
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Philadelphia
Athletics



There's a triple play in every
tin of Velvet... it tastes right in a cigarette
... it smokes cool in a pipe... bite is O-U-T!
Made from maple-flavored Burley, aged
two years or more in wood... it rolls a
better cigarette and packs easy in a pipe.

Velvet

*the Right Word
for Smooth Smoking*
MILD and COOL
Positively NO "BITE"

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Popular Mechanics Magazine

H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

July, 1940

Vol. 74, No. 1

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Sea Giants on Parade

PORPOISES are like playful puppies. Down at the Marine Studios in Florida you'll see one of these 400-pound practical jokers shoving a sleepy 200-pound turtle around the tank just to be ornery. Sometimes a porpoise will dive to the bottom with a rubber ball in its mouth, let the ball go and then race it to the surface—whistling through its cranial blowhole for sheer joy. Scientists as well as tourists are learning about life in the sea through the portholes of this salt-water observatory. Take a look, yourself, at the Marine Studios in the eight-page August Coloroto section.

Miracle Men of the Corn Belt

WHAT the midwestern farmer wants is a breed of corn that resists searing sun and winds, corn that's amenable to the mechanical picker and that chinch bugs, grasshoppers and diseases will pass by. They want a miracle. Well, they're getting it. Read next month how they're tailoring these traits into corn and shooting at 200 bushels to the acre.

Next Month

QUICK as a wink? That's only a fortieth of a second. They're taking photographs now with exposures of 1/3,000,000th of a second—stopping the flight of bats, "freezing" the agile tongue of a cat lapping milk, halting a bullet shattering a light bulb and even showing the sound and heat waves caused by a bullet's flight. This incredible high-speed photography and its role in modern industrial research are described in an August story, "Quicker Than a Wink—and Then Some."

Try the Easy Way

MOST people do things the hard way. The human body is a remarkable piece of architectural engineering, and if it's used properly—with some intelligent application of body mechanics—you can carry a loaded trunk or pedal a bicycle, shovel snow or pitch a baseball with the least possible expenditure of energy. A sculptor offers expert advice on how to work and play efficiently in a feature next month entitled "Why Not Try the Easy Way?"

Super-Speed Roads

PICTURE yourself in your 1960 teardrop car flitting from Washington to San Francisco in a day on a 100-mile-an-hour multi-lane highway, kept a safe distance from the car ahead by a radio block system like today's automatic train control. Norman Bel Geddes, noted industrial designer, says it's possible. Take a trial trip in the story next month.

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If heat worries you, it "worries" your car ten times over. Excessive heat can cause lubrication failure. Then wear occurs on metal parts. And WEAR means trouble ahead. If you have Pyroil in your car you don't have to worry about this. Pyroil has a special, different, type of film that is heat proof. It is a dependable safeguard against lubrication failure and resulting wear. It protects your car and your pocketbook!

Next time you drive into your favorite service station or garage, ask to have your car conditioned with Pyroil. Twelve ounces or a pint in crankcase. Three ounces in gas tank. Then you'll have dependable, heat proof protection for vital parts!

Pyroil rids your engine of contaminations, too—hard carbon, gum, sludge, acid and corrosion. Try it today! Manufactured and Guaranteed by Pyroil Company, W. V. Kidder, Founder, 57 Pyroil Bldg., LaCrosse, Wisconsin, U. S. A.

Want to Know How Pyroil Works and All That It Does? Send Coupon Below for Free Booklet, Questions and Answers."



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*Ever wish you had Cat's Eyes
for Night Driving?*

G-E ANNOUNCES NEW INVENTION TO TRIPLE LIGHTING ON OLDER CARS

If you've ever wanted cat's eyes for night driving... if you've envied the safety and comfort of the new Sealed Beam headlighting on 1940 cars... here's what you've been waiting for! Two revolutionary new G-E MAZDA lamps, in auxiliary units inexpensively installed on the bumper at any good garage or service station, work automatically with old headlights to triple the road lighting on average pre-1940 cars. Amazingly efficient, hermetically sealed "All-Glass" construction. No dirt or moisture can "breathe" in to dull the reflectors. And with no inner bulb, the effect of blackening is greatly reduced.

See these new lighting units today. And for your own protection, check these 4 points before you buy:



- 1 **BE SURE** you get 2 units, 1 "driving", 1 "passing".
- 2 **BE SURE** they have "All-Glass" G-E MAZDA Driving and Passing Lamps.
- 3 **BE SURE** units are properly wired, with relays for full efficiency, a cutoff switch for city driving.
- 4 **BE SURE** they're properly aimed to put light where needed for safer seeing.



THE NEW G-E MAZDA Driving and Passing lamps are especially designed to supplement pre-1940 car lighting. Be sure to dim your lights when passing other cars.

The new "All-Glass"
G-E MAZDA AUTO LAMPS
GENERAL ELECTRIC



DRIVING BEAM on average pre-1940 car produces only about 20,000 beam-candlepower before addition of new "All-Glass" G-E lamps.



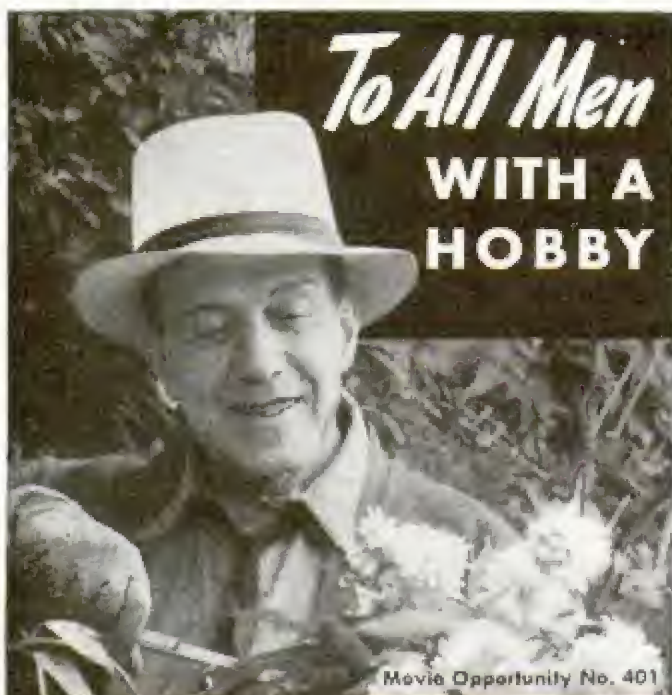
NEW G-E "DRIVING LAMP" (only 30 watts) adds 35,000 beam-candlepower. Cleaning reflectors and lenses of old headlamps further increases light.



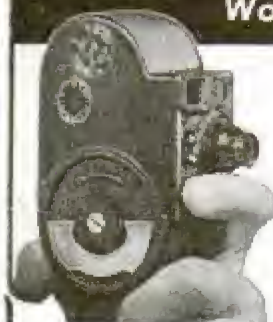
TRAFFIC BEAM of pre-1940 cars, dimmed by dirt and moisture on reflectors, makes passing other cars hazardous.



WITH G-E "PASSING LAMP" added, you get more light far ahead along the right curb and at sides of road where you need it.



Filmo Movies Make Your "Play Work" Much More Fun!



PALM-SIZE *Filmo 8*

only \$49.50

Easy Terms
Other Models to \$1155

WHAT is your hobby? Gardening? Your home workshop? Fishing? Hunting? Whatever it is, you'll get more pleasure from your hobby if you make movie records of your methods, your progress, your results.

Even difficult subjects are easy to record, in color and motion, with a Filmo Camera. Just press a button, and *what you see, you get . . .* at snapshot cost. With four speeds including slow motion, device for animation work,

and provision for adding extra, special-purpose lenses and accessories as your skill grows, Filmo is a basic camera that will meet your present and future needs. Superb results are certain, for Filmo is precision-built by the makers of Hollywood professional equipment.

Mail coupon for booklet. Bell & Howell Company, Chicago; New York; Hollywood; London. *Established 1907.*

FREE Movie Booklet

BELL & HOWELL COMPANY
1844 Larchmont Ave., Chicago, Ill.
Send free, 16-page booklet about Filmo
8 mm. movie equipment.



Name.....

Address.....

City..... State..... PM 7-40

PRECISION-MADE BY
BELL & HOWELL

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WHICH OF THESE MEN IS YOU?



Is This You?

OR

Is This You?



1. "My name is Stark. I'm never late mornings. I get back promptly from lunch—often work overtime cheerfully. I carefully do every single job they give me and in six years I have done each job so many times that I'm letter-perfect! Only one little raise so far, but some day I ought to get a good one. I'm probably the steadiest, most loyal employee in the whole office. One of these days the boss will realize that I'm the best man who ever worked on this job. Then I'll show these other fellows a thing or two!"

2. "My name is Baker. I've only been here a year, but the jobs they give men like Stark and me are too easy. In three months I saw I could never get far ahead on routine work like this. So I began to look for ways to increase and improve the work in my department. I'm taking home-study training that's helping me a lot. My boss heard about it and complimented me. Next month I'm going to be made Assistant Department Head at 40% more money. After that—well, we'll see. But you can bet I'm still studying!"

DON'T you recognize both these men in your office? One is a slow plodder—the other an energetic go-getter. Stark thinks of himself—Baker, of his company.

Stark runs along comfortably in a rut—*hopes* for a big raise. Baker pulls himself out of ruts—*gets* a big raise. And goes right on training for *another* one!

It's men like Baker who turn to LaSalle business training because of what it *gets* them! And they know it gets them *plenty* because the proof is plain to read in the grateful letters—and the successful lives—of thousands of LaSalle graduates.

You too can join the ranks of the "comers" like Baker if you'll "train on the

job you've got—to get the job ahead!" It all depends on you—the height of your ambition and your readiness to investigate, then study systematically and seriously.

The LaSalle Success Road is cleared and ready for earnest adults—has been traveled for thirty years. Its first sign-post has always been a man's name on a coupon like the one below.

It costs absolutely nothing to send such a coupon. But sending it may mean the turning-point in your whole life. Mail it! At least *find out* about LaSalle's road to better jobs—more money—success! There's no time like *NOW*!

LASALLE EXTENSION UNIVERSITY, A Correspondence Institution
Dept. 764-R CHICAGO

I am ambitious like Baker. Tell me how I can prepare for larger success—and send me your free booklet on the field I have checked below:

☐ Executive Management ☐ Law: LL.B. Degree ☐ Salesmanship
☐ Accounting ☐ Traffic Management

Name.....Age.....

Position.....

Address.....



LaSalle EXTENSION UNIVERSITY
A CORRESPONDENCE INSTITUTION

This One

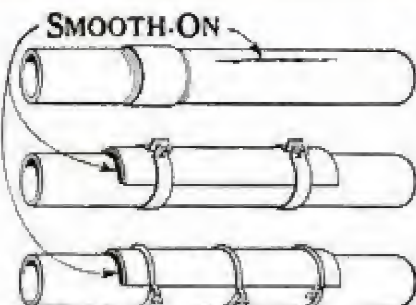


7A79-Y05-BB-TP

A "First Aid" for Repair Work

around the house—in the shop—on the car

Sealing a leak in a water or steam pipe in place is one of the hundreds of home repairs that can be done easily and economically with Smooth-On No. 1.



When leaks occur on heating systems or water lines, when cracks develop in heating boiler, automobile engine or other castings, when metal fixtures or machine parts become loose—these are the times that a can of Smooth-On No. 1 will save much time, effort and money. Smooth-On is easily applied without dismantling the part to be repaired, requires no heat, special tools or previous experience, and makes a permanent pressure-tight and vibration-proof seal.

FREE — the 40-page Smooth-On Handbook

This concise practical repair manual enables any handy man to be his own repair mechanic on dozens of jobs that would otherwise mean the delay and expense of getting a professional. More than 160 diagrams show ingenious and proven methods of making cracked, broken, leaky or worn apparatus fully as serviceable as when new, and assuring permanently good results on new construction work. This useful guide is literally a necessity in every home and shop and will be sent you FREE if you fill in and return the coupon.

Get Smooth-On No. 1 in 1 $\frac{3}{4}$ -oz., 7-oz., 1-lb. or 5-lb. can from your hardware store, or, if necessary, from us. For your protection, insist on Smooth-On, used since 1893.

SMOOTH-ON MFG. CO., Dept 37
574 Communipaw Ave.,
Jersey City, N. J.
Please send Smooth-On Repair Book.

Name

Address

7-40



Do it with SMOOTH-ON

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IMPORTANT NOTICE

It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts. We take no responsibility as to whether the disclosures contained in our articles are covered by patents and advise readers to investigate this subject before making, using, or selling any of the products, machines, or processes described, in order to avoid possible liability for patent infringement.



the Case of the Crying Wife

1 Ann doesn't cry easily—but that night I found her in tears! "I can't help it," she sobbed. "All the things we were going to do—buy a car, build a home—remember? And here we are—married three years, and just barely making ends meet! I thought our dreams might come true—but it's no use." I made up my mind right then to "have it out" with the boss.



2 "Look here!" he said. "I can't *pay* you more unless you're *worth* more! And frankly, John, you lack the *training* a bigger job needs. Ever hear of the International Correspondence Schools?"



3 When I learned the boss was a former I.C.S. student, I signed up *quick*! And what a difference it made in my work! I'd never realized until then how *little* I knew about the business.



4 I'm happy, and Ann's happy, and I guess the boss is happy. (At least I've had two "raises" in the last year!) And here's the very same coupon that I mailed, staring you in the face!

INTERNATIONAL CORRESPONDENCE SCHOOLS

BOX 5581-J, SCRANTON, PENNA.



Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the course *before* which I have marked X:



TECHNICAL AND INDUSTRIAL COURSES

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| <input type="checkbox"/> Air Conditioning | <input type="checkbox"/> Architectural Drafting | <input type="checkbox"/> Diesel Engines | <input type="checkbox"/> Mechanical Drafting | <input type="checkbox"/> Sanitary Engineering | <input type="checkbox"/> Sheet Metal Work |
| <input type="checkbox"/> Architecture | <input type="checkbox"/> Auto Engine Tune-up | <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Mechanical Engineering | <input type="checkbox"/> Steam Electric | <input type="checkbox"/> Steam Engines |
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| <input type="checkbox"/> Bridge Engineering | <input type="checkbox"/> Aviation | <input type="checkbox"/> Fire Boilers | <input type="checkbox"/> Navigation | <input type="checkbox"/> Structural Engineering | <input type="checkbox"/> Surveying and Mapping |
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| <input type="checkbox"/> Chemistry | <input type="checkbox"/> Bridge Engineering | <input type="checkbox"/> Heat Treatment of Metals | <input type="checkbox"/> Pharmacy | <input type="checkbox"/> Toolmaking | <input type="checkbox"/> Welding, Electric and Gas |
| <input type="checkbox"/> Civil Engineering | <input type="checkbox"/> Building Estimating | <input type="checkbox"/> Highway Engineering | <input type="checkbox"/> Plumbing | <input type="checkbox"/> Woolen Manufacturing | |
| <input type="checkbox"/> Coal Mining | <input type="checkbox"/> Chemistry | <input type="checkbox"/> House Planning | <input type="checkbox"/> Poultry Farming | | |
| <input type="checkbox"/> Concrete Engineering | <input type="checkbox"/> Civil Engineering | <input type="checkbox"/> Locomotive Engineer | <input type="checkbox"/> Practical Telephony | | |
| <input type="checkbox"/> Contracting and Building | <input type="checkbox"/> Coal Mining | <input type="checkbox"/> Machinist | <input type="checkbox"/> Public Works Engineering | | |
| | <input type="checkbox"/> Concrete Engineering | <input type="checkbox"/> Management of Inventions | <input type="checkbox"/> Radio, General | | |
| | <input type="checkbox"/> Contracting and Building | <input type="checkbox"/> Managing Men at Work | <input type="checkbox"/> Radio Operating | | |
| | | <input type="checkbox"/> Manufacture of Pulp Paper | <input type="checkbox"/> Radio Servicing | | |
| | | | <input type="checkbox"/> R. R. Section Foreman | | |

BUSINESS COURSES

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| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Business Correspondence | <input type="checkbox"/> College Preparatory | <input type="checkbox"/> Foremanship | <input type="checkbox"/> Salesmanship | <input type="checkbox"/> Service Station Salesmanship |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Commercial | <input type="checkbox"/> French | <input type="checkbox"/> Sign Lettering | <input type="checkbox"/> Spanish |
| <input type="checkbox"/> Cartooning | <input type="checkbox"/> Business Management | <input type="checkbox"/> Cost Accounting | <input type="checkbox"/> High School | <input type="checkbox"/> Traffic Management | |
| | | <input type="checkbox"/> C. P. Accounting | <input type="checkbox"/> Illustrating | | |
| | | | <input type="checkbox"/> Lettering Show Cards | | |

DOMESTIC SCIENCE COURSES

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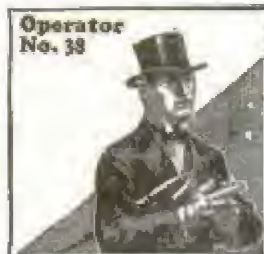
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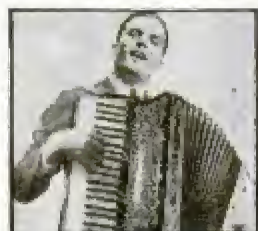
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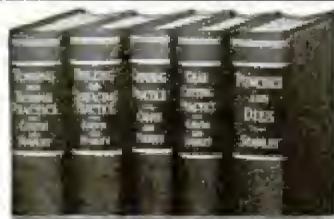
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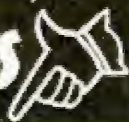
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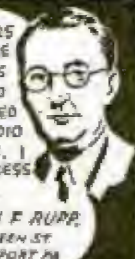
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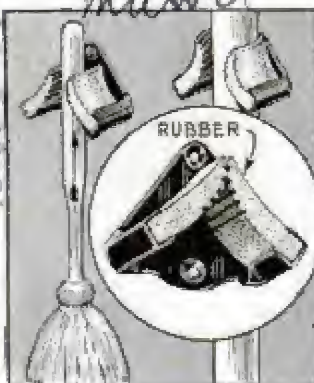
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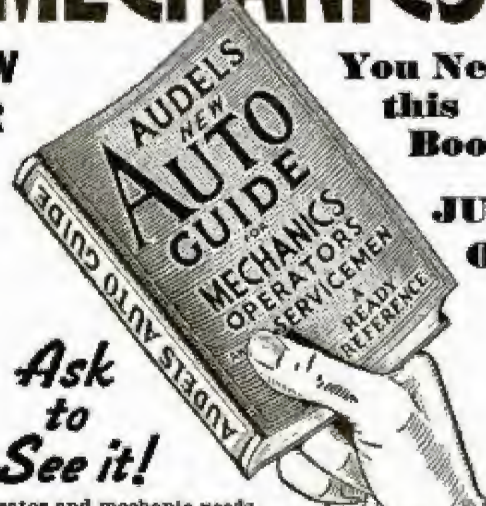
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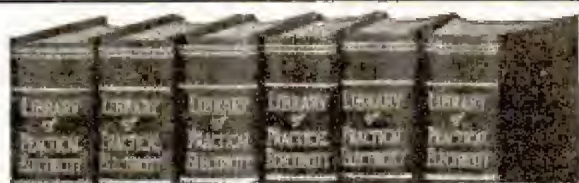
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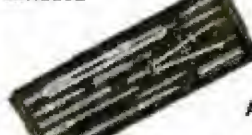
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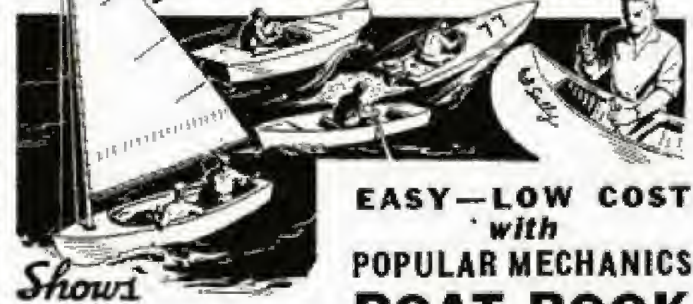
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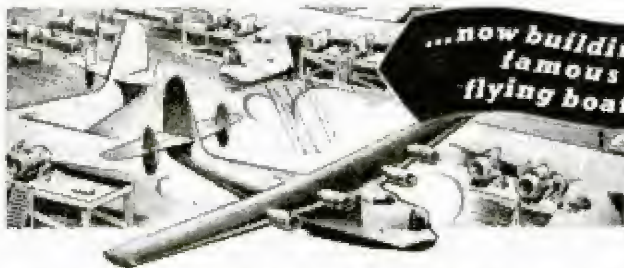
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ANGORA Wool rabbits pay. America's fastest growing industry. Start now. Dakota Rabbitry, Oakes, North Dakota.

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ANNOUNCING New home study course in commercial baking. Good field for ambitious men. Nearly depression proof business. Common school education sufficient. Send for free booklet "Opportunities in the Baking Industry" and requirements. National Baking Institute, 3601 Michigan Avenue, Dept. 3434, Chicago.

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EXCELLENT Sparetime profits taking subscriptions—2500 magazines. Agents confidential catalogue, complete starting supplies free! Dept. 11, Pines, 583 Monroe, Brooklyn, N. Y.

ROLLER Skaters! Subscribe to The American Roller Skater! Contains all the skating news. Membership in national club free! Sample 15c. The American Roller Skater, 1472 Broadway, New York.

W.P.A. 2 handled shovel, seat; C.C.C. 2 hoier hustle house. Comic postcards, 6 for quarter. Cartoonist, B. R. Falls, Wis.

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182 THINGS You can easily make for fun or profit, 50c. Popular Mechanics Press, Room C40, 200 E. Ontario, Chicago.

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PLAY "Uno" the new fascinating all American game played with the states. Two or more can play "Uno." A fine colored United States map with each game. Introductory price, 25c postpaid. Satisfaction guaranteed. Dealers write for prices. Print name and address plainly. The Uno Game Co., Kenosha, Wis., Box 205.

TWELVE-WAY Option. Fascinating. Interesting. P.O. Box 342, Denver, Colo.

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SELL Your game! If you have devised a new game and want to market it, send 3c stamp for particulars. Trend Games, Highland Park, Ill.

PLAYS, Operettas, musical comedies, complete minstrel first-parts with song programs, blackface skits, vaudeville acts, monologs, dialogs, recitations. Juvenile plays and songs, musical readings, entertainments, make-up goods. Catalog free. T. S. Denison & Co., 203 N. Wabash, Dept. 11, Chicago.

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ILLUSTRATED Novelty catalog, and gift, 5c. Frank Wencel, Hamtramck, Mich.

FUNNY Tricks and jokes magic. Free list. Littlecote Stamp Shop, Utica, N. Y.

BE A magician. Large professional magic catalogue of latest tricks 25c. Cash paid for complete Tarbell Magic Courses. Write, Ireland, C-109 North Dearborn, Chicago.

MAGICIANS' Headquarters. 216-page catalog pocket, parlor, professional tricks, 25c. Kanter's, 1309 Walnut, Philadelphia.

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EARN Money in any crowd. Call names of strangers, tell unspoken questions. Professional course mind reading, spirit writing, etc., \$1. Henderson, Box 341, San Bernardino, Calif.

WORLD'S Largest professional magic shop keeps you in touch with latest tricks. To receive mailings send 25c for 1940 catalog. Holden, 220 W. 42nd St., New York.

LEARN Ventriloquism, 3c stamp brings particulars. Smith, 801 Bigelow, Peoria, Illinois.

LARGE Magic catalog 25c. Hundreds of tricks. Chicago Magic Company, 2300 N. Mason Avenue, Chicago.

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COIN Packet, 100 all different coins, copper, nickel, silver, some over 100 years old, \$2.00, postpaid. Koepfel Coin-Shop, 8th at Broadway, Los Angeles.

INDIAN Head penny with list 10c. Charles Banker, Salina, Kansas.

OLD Money wanted. Will pay fifty dollars for nickel of 1913 with Liberty head (no buffalo). We pay cash premiums for all rare coins. Send 4c for large coin folder. May mean much profit to you. Numismatic Co., Dept. 20, Fort Worth, Texas.

15 DIFFERENT Coins 25c. Oddehon, Box 44, Overland, St. Louis, Mo.

RARE Coins. Latest bargain catalogue —10c. Eugene Morrison, Reseda, Calif.

OFFICIAL Gold souvenir coin. Golden Gate International Exposition. San Francisco. Send \$3 money order to Jules Charbonneau, 645 Stockton St., San Francisco, Calif. Silver coin 75c.

UNITED States coins. Registered appraisal. You may have \$20,000 coin or collection, 10c a coin. Insured return. Coin Appraisers, Clairton, Penna.

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SCARCE Mint stamp, cataloging 50c, only 10c coin with approvals. Campbell, Box 425, Metropolis, Illinois.

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NEJD (Arabland), Bolivia triangle, Caymans, Negri Sembilan, Turks Caicos, Manchukuo, Bahamas, British Solomons (Cannibaland). Everything 3c with approvals. Viking, 130-Z Clinton St., Brooklyn, N. Y.

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STAMP Collections bought. Send to N. Barcus, 3787 Longfellow, Detroit.

PENNY Approvals by country. M. H. Hoerning, Merriam, Kansas.

SEND Postage for free United States price list, precancel list, Stanley Gibbons, 33-P Park Row, New York.

50 LARGE French Colonials, 3c. approvals. Kravat Company, 1925-Q Quentin Road, Brooklyn, N. Y.

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IF You buy, sell, exchange stamps send 10c for valuable information. Williams, Box 4100, Portland, Oregon.

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1000 ALL Different stamps from the world 80c. 500—35c. 300—20c. Many similar bargains. DeMers, Box 1033, Milwaukee, Wisconsin.

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NUDE Duchess set (2 varieties.) 5c—approvals. Shultes, Berne, N. Y.

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PENNY Approvals, that satisfy. Neil Gronberg, Box 5441-P, Philadelphia, Penna.

600 DIFFERENT 50c; 1111, \$1; 2000, \$2.50. Fred Onken, 630 79th Street, Brooklyn.

45 DIFFERENT United States, gauge, hinges, price list—all for 10c. Seidenberg, Baroda, Mich.

SCARCE Diamond airmail! Wonderful packet 115 different from strange countries. British Colonies, Haiti, Tasmania, pictorials, etc. 5c to approval applicants. Reliable Co., Box 139, Dept. 3, Church Annex, New York.

FREE—The Stamp Finder! Our new 24 page edition, fully illustrated, which will enable you to instantly identify all difficult stamps. Also fine packet of odd and unusual stamps from Bosnia-Herzegovina, Monaco, Patiala, Cyprus, etc., including maps, ships, animals and strange scenes. All free to approval applicants inclosing 3c postage. Garcelon Stamp Co., Box 900, Calais, Maine.

25 UNITED States, including \$4 and \$5 stamps free to approval applicants. 3c postage. Brownie Stamp Shop, Flint, Mich.

SMOKY Mountain commemorative sheet, largest U. S. stamp issued, and 33 U. S. including commemoratives, airmail, revenues, etc. Catalogs 75c—To approval applicants for 5c. Curhan Stamp Company, Gloucester, Mass.

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GIANT Packet 200 all different from Africa, South America, Asia, South Sea Islands, etc. Includes world's smallest stamp; triangle and diamond-shaped stamps; animal stamps. Nicaragua "Will Rogers" airmail; many others. Also packet 17 different United States (cataloging 50c)—all obsolete, including \$4 denomination, commemoratives, etc. Total catalogue price over \$5.00! Everything for only 5c to approval applicants! Mystic Stamp Company, Dept. 80-N, Camden, New York.

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EXCHANGE Your duplicate stamps, match covers, etc., with collectors everywhere. List, swappers, dime. (Mention hobby.) Secretary, Box 2166, Denver, Colo.

UNUSED Book match covers, 100 all different, \$1.00. Free list. Charles Edelman, 1311C East 84, Cleveland, Ohio.

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INTRODUCTORY Offer! Rolls developed, printed 15c. Donald Lehman, 1828 South Compton, St. Louis, Missouri.

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CONFUCIUS Say: "Patronize Gem for skilled workmanship." Rolls developed, 8 guaranteed prints including 5x7 enlargement 25c coin. Gem Photo Service, 3355 West 63rd, Chicago, Ill.

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TWO Salon quality tinted enlargements, trial roll developed, eight permamane prints—25c. Color by studio professionals. Colorcraft, 2510-P, Hollywood, California.

NO Tricks, no schemes, no ups. Any picture copied or negative enlarged "5x7" colored embossed and mounted 25c. (5 for \$1.00). 15c extra you get copy negative. Carrs Colorfoto Studio, 60 W. Flagler St., Miami, Fla.

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16 PRINTS—2 Free enlargements. Special, get-acquainted offer: Any 6 to 16 exposure roll developed and printed with beautiful guaranteed never-fade prints plus folding folio frames for your snapshots and 2 free enlargements 25c. Dean Studios, Dept. 2074, Omaha, Nebraska.

NEW Sensational offer! Roll developed, 16 beautiful prints, one enlargement and best photo on attractive button complete, 25c. Overnight service. United States Photo, 224 West Huron, Chicago.

BIG Bargain! 20 prints from each roll, or 16 prints plus 2 Micro enlargements 25c! Free mailers. Photo Friend, 103, Litchfield, Illinois.

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ROLL Developed and 8 lustrous, natural finish, permanent Velox glossy prints 25c—reprints 3c each. Fotoprint Service, Box 1, Roanoke, Virginia.

ANY Size roll developed, 8 glossy prints plus two "5x7" enlargements, 25c coin. Quality Photo Service, Winder, Georgia.

OIL Coloring photographs a fascinating hobby or profitable business. Learn at home by easy simplified method. Previous experience unnecessary. Send for free information and requirements. National Art School, 3601 Michigan Avenue, Dept. 343B, Chicago.

TWO Beautiful professional double weight enlargements, eight lifetime prints, 25c. Prompt—careful. Film mailers free. May's Photo Shop, Box 870-AL, LaCrosse, Wis.

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5x7 ENLARGEMENTS 10c From negative. Rolls developed, printed 20c. Catlin Films, Catlin, Ill.

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MILLIONS Enjoy sparkling Lifetone prints. Two sets hyglass enamel prints, 2 free enlargements every roll 25c. Lifetone Studios, Des Moines, Iowa.

ROLL Developed 16 Velox or 8 double size prints, 25 cents. 24 hour service. Film Laboratory, Box 2205, Philadelphia, Penna.

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MICROGRAIN Candid developing. 36 exposure developed $3\frac{1}{2} \times 4\frac{1}{2}$ " plus Eastman Super-X reload—\$1.00. Micrograin Laboratories, N-39, Des Moines, Iowa.

ENLARGEMENTS On beautiful portrait paper—Four 8x10 \$1.00. Six 5x7 \$1.00. Ten 4x6 \$1.00. Miniservice, Dept. PMS7, Box 318, General P.O., New York.

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PROFESSIONAL. Overnight, eight prints, two enlargements. 25c. Fotoservice, 1942-D Marlow, Toledo, Ohio.

FOUR Beautiful 5x7 enlargements, two sets guaranteed fadeproof glossy prints with your roll film developed only 25c. Trial offer. Reprints 16 for 25c. ARO Studios, Dept. 12, Des Moines, Iowa.

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ROLL Developed. 16 artistic deckled edged permanent prints, 25c. Reprints, 3c each. 100 reprints, \$1.50. "As reliable as Uncle Sam's mail!" Midwest Photo, Room 554, Janesville, Wisconsin.

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TECHNIFINISH—35mm., 36 Exposure rolls including "Mercury" fine grain developed and perfectly enlarged to 3" by 4" glossy prints, 85c. New, exclusive methods and equipment make this low price possible. Cartridge reloaded with Eastman Plus X, 25c. One day service. Satisfaction guaranteed or money back. Write for free mailing bags and information. Technifinish Laboratory, 104-H, Lexington, Rochester, N. Y.

75c-36 EXPOSURES 35mm. Developed, enlarged. Graphic Photos, Gardner, Mass.

DOUBLE-QUICK Service! Roll developed 16 Velox prints; or 8 prints, 3 enlargements 25c. Chicago Photo Lab., Box 3A, South Chicago, Illinois.

EXTRA Fast service. Roll developed, 16 prints 25c. Send for free mailing envelope, price list. Star Photo, Dept. R, 20 W. Jackson, Chicago.

FREE! Best snapshot on attractive photo button with 16 prints each roll 25c. Beautiful novelty premiums. Novel-Ad Co., BM-3327 North Ave., Chicago.

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YOU Get one 5"x7" silk enlargement. Send negative—10c—P.D.Q., Elmhurst, Ill.

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MILLIONS Now know "Hollytints Means Better Prints." Two enlargements, eight prints with trial roll developed—25c. Framed enlargement coupon free. Hollytints, P-1350 Hollywood, California.

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ROLL Developed and printed, two enlargements, one in colors, all for 25c coin. Photo Finisher, Station E, Box 42K, Columbus, Ohio.

ROLLS Developed latest methods. 2 prints each 25c. Reprints 2c. Unusual results guaranteed. Heen Photo Service, Highland Station, Box 2651A, Minneapolis, Minnesota.

ROLL Developed, 16 Velox prints 25c or 8 prints and 2 enlargements. Rapid, Villa Park, Illinois.

THE Modern Finishers, St. Paul, Minn., are the outstanding finishers in America for low prices, fast service, guaranteed neverfade pictures. Roll developed 8 Modertone prints 20c. Roll developed, 16 Modertone prints 25c. Reprints 2c each, 16 for 25c. Coupons on enlargements. 35mm, 36 exposure roll developed fine grain, 1 each enlarged \$1.00.

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EXTRAORDINARY Moneymaking ideas! Worldwide propositions. Stamp appreciated. Worldwide Service, Box 5450, Metropolitan Station, Los Angeles, California.

HUNDREDS Money-making opportunities 5c. Central Distributors, Sidney, Man., Can.

MAKE 600%. Plan 25c. Nubia Company, 770 Columbia Road, Washington, D. C.

"LUMINOUS Paint" shines in dark. Easily made. 300 other formulas, plans—all 25c. Ideal Service, 390P7, Park Ridge, Ill.

PROFITABLE Mailorder opportunities, magazine, 3c. Kay's Service, 3916 Telegraph, Oakland, Calif.

WANT Extra money? Write: Elar, 2634 N. 25th, Milwaukee, Wis.

INCREASE Weekly income \$10 to \$25. Literature free. O. Grube, Egg Harbor, N. J.

PROFITS Day-night, year around. No selling. Operate "Silver King"—"King Jr." vendors. \$3.95 up. Free instructions. Automatic 2422-A Fullerton, Chicago.

LIVE Money makers! Six months' service 15c. Carl Greiner, Balleys Harbor, Wis.

YOU'LL Like resilvering mirrors, reflectors, making chipped glass nameplates, signs. Write Sprinkle, Plater, 287, Marion, Indiana.

BOOKKEEPERS Make money, new bookkeeping service, Box 614, Kalamazoo, Michigan.

MAKE Money—Others do—Collecting reptiles, toads, frogs. Easy! Profitable! Sure! We buy all varieties. Particulars dime. Biological Research Laboratories, Dept. 3D, Little Rock, Arkansas.

MILLION Articles. Buy wholesale. Valuable directory 10c. Ideal Service, D-7, Park Ridge, Ill.

MONEYMAKING Mailorder business. Easily started anywhere. Valuable information 10c. Halcot Enterprises, Box 2981-P, Dallas, Texas.

"CASH In" on your spare time. 300 money-makers. 64-page book. 40,000 words, business secrets, formulas, 25c postpaid. Hopko, Box 643, Union, N. Y.

EARN Extra money, particulars, gift, dime. Rogers Service, Moose Lake, Minn.

FILING Saws easy this new way. One dollar hour easy. No expensive machine to buy. Instructions \$1.00. Harvey Pickett, Garden City, Iowa.

CASH Paid for insects. See Sinclair display advertisement on page 10A.

TYPISTS! Earn money addressing envelopes, circulars, typing. Information 10c; none free. Ace-PMG, 316 Empire, Birmingham, Ala.

AFTERNOONS Free! Work home! \$2,000 month reported (exceptional case—full-time). Expect surprise answer! National, Box 1240-CF, San Bernardino, California.

MAKE. Sell, bleach. Details, stamp, Hyland, 4723 Race, Chicago, Ill.

REFINE Used oil without cost, formula 25c. Southern, Box 3303-A, Jacksonville, Florida.

BE A professional scrapbooker. Big fees. Unlimited opportunities. Can be done at home. No competition. No capital needed. Write to Scrapbookers Guild, 59 Park Place, New York, N. Y.

BE Independent. Sell by mail, buy wholesale. Wetzel, Valhalla, N. Y.

"SCHEMER" Magazine, Alliance, Ohio, (42nd year) answers questions, prints schemes, opportunities, helpful hints, profit paragraphs, advertising rates, formulas. Copy, and special subscription offer, only 10c.

MOULDS. Guaranteed, for casting toy soldiers, Indians, trappers, warships, sinker moulds, 244 kinds. Send 5c for illustrated catalogue. Send \$1.00 for large sample mould. Henry C. Schiercke, 645 Spencer, Ghent, N. Y.

"RAISE Earthworms for profit," new, interesting home business, Bureau Zoological Research, 106A Broadway, Peoria, Ill.

AMATEUR Cartoonists, earn cash at home, copying and duplicating cartoons for advertisers. Ad-Service, Arkyle, Wis.

WHOLESALE Sources, 500,000 articles. Free directory. Maywoode, 1107 Broadway, New York.

GROW Plants without soil. Folder free. Gordon Laboratories, 1265-J Broadway, New York.

PROFITS Day-night, year around. No selling. Operate "Silver King"—"King Jr." vendors. \$3.95 up. Free instructions. Automatic, 2425-A Fullerton, Chicago.

FORMULAS, PLANS, ETC.

FORMULAS—Three fast selling products. Moneymakers. 25c. Maxwell, 966 Pink, Richmond, Va.

SOILLESS Plant, plating, other solutions. Write for prices. J. B. Laboratories, 305 East 171 St., New York City.

INSECT Spray formula: Materials 25c. Kaplan, 13 S. Eden, Baltimore.

10,000 PROFITABLE Formulas, secrets. Original, unabridged 900 pages, \$1.50 postpaid or C.O.D. Adams Brown Company, Chestnut Hill, Massachusetts.

110 SUCCESSFUL Formulas, \$1.00. Carl A. Jonas, 27 Church Street, Lowell, New York.

FORMULAS: — "Chemist Approved." None better. Lowest prices. Catalog free. Kemico, 12-G, Park Ridge, Ill.

135 SINGLE-INGREDIENT Formulas, \$1.00 postpaid. A. Kinford, Warne, Penna.

GUARANTEED Formula for any product! "Just name it." Valuable information free. Miller's Analytical Service, Tampa, Florida.

AUTO Polish formulae—50c. Tee Gee Distributors, Box 454, Wilkes Barre, Pa.

USE Peerless "Plus + Violet" reversible movie films for better movies at less cost. Weston 12, daylight loading spools, free processing. Univex, 60c each, two rolls for \$1.00; 25 ft. double 8mm, \$1.00, four rolls for \$3.50; 100 ft. 16mm, \$2.35, four rolls for \$8.00. (Also bulk). Details free. Peerless, Box 1310P, Hollywood, California.

AFTERNOONS Free! Work home! Expect surprise answer! National, BX1240-T, San Bernardino, California.

ICELESS Ice! Colder! Cleaner! Cheaper! Instructions 25c. Duffy, Covington, Ky.

THAXLY Formulas, processes, for perfect products. Accurate analyses. Catalog free. B. Thaxly Co., Washington, D. C.

FORMULAS—All kinds. Real money-makers. Lowest prices. Catalog free. Clover Formulary, 108-P3, Niles Center, Ill.

REAL Manufacturing formulas, lists free. Cummings, Chemist, Gordon Avenue, Syracuse, N. Y.

FORMULAS. Latest money makers. Literature free. Belfort, 4042 N. Keeler, Chicago.

ELITE Formulas and plans; make and sell your own products. Descriptive booklet free. Elite Co., 214 Grand St., New York.

"PUNCTURESEAL" Automobile tires 15c. Selfsealing. Particulars. O. Gerwin, Fairview, Oklahoma.

CHEMISTRY

FREE: 40 Page catalog of chemical and laboratory supplies for amateur chemists. Wollensak microscopes and supplies, scientific books at big discount. JET Winn, 124 West 23 Street, N. Y. C.

FREE Chemistry catalog. Supplies at 5c! Equip complete laboratory. Kemkit Scientific Corp., 397P Bridge St., Brooklyn, N. Y.

CHEMICALS, Laboratory, glassware, apparatus. Send 3c for catalog CPI. Biological Supply Company, 1176 Mt. Hope Avenue, Rochester, N. Y.

SPECTROSCOPE For quick chemical analysis \$2.50. Kutting Sons, Campbell, California.

CHEMICALS In 5c quantities. Catalog 5c. Fleischler's Laboratories, Medford, Mass.

HELP WANTED

LOCAL Agents wanted to wear and demonstrate suits to friends. No canvassers. Partial payment plan. Up to \$12 in a day. Experience unnecessary. Valuable demonstrating equipment, actual samples free. Stonefield Corp., 1300 Harrison, Dept. G-817, Chicago.

M. M. Earned \$1174 in spare time for exceptional "cellar crop" Snow-King mushrooms! Free book tells if your cellar, shed suitable. We buy crops. United, 3948 Lincoln Ave., Dept. 60, Chicago.

RELIABLE Information how to secure employment, 25c. Johnson, 6745 Indiana, Chicago.

BOOKKEEPERS—Learn credit management from experienced credit man. Cooke, 41 Washington St., Rutland, Vt.

SALARIED Positions—\$2500 yearly and up (none lower). Let us find one for you. Small cost. Write for valuable information. Executive's Promotion Service (16), Washington, D. C.

AGENTS WANTED

DEALERS: Sensational seller. In United States, free sample. Girards, Washington, Ohio.

MAKE Money—Sell new "Get Acquainted Badges." Request sample. DeFreese, 1042 W. 90 St., Los Angeles, Calif.

AGENTS Wanted for window cleaner. Details. Ward, 97B Saybrook, Connecticut.

REVOLUTIONARY Window cleaning tool. Good Housekeeping approval. Only ten \$2.25 sales daily to housewives, factories, schools, stores will make you \$350.00 monthly. Carter Products Corp., 907 Front Ave., Cleveland, Ohio.

WASHED Water, new invention, necessity every home. Filters, softens, purifies hot or cold water. Agents, distributors write. 2991 Grand River, Detroit, Mich.

FIREWORKS ½ Price. A. J. Fink, Box 114, Dayton, Ohio.

UP To 500% profit with new perfected 1940 quick action, no flint, automatic gas lighter. Retails 25c. Sample 10c. New Method Company, Box PMG-91, Bradford, Penna.

MAN And wife to run fine paying local grocery agency. Wonderful earnings all year round. No experience required. Full particulars and trial offer mailed free. Ed. Mills, 3547 Monmouth, Cincinnati, O.

DON'T Be a job hunter—Start your own business on our capital. No hard times; no lay-offs; always your own boss. Hundreds average \$3,000 to \$5,000 annual sales year after year. We supply stocks, equipment on credit. 200 home necessities. Selling experience unnecessary. Wonderful opportunity to own pleasant, dignified, profitable business backed by world-wide industry. Write Rawleigh's, Dept. G-U-PPM, Freeport, Ill.

BUSINESS Proposition resilvering mirrors, reflectors, making chipped glass nameplates, signs. Write Sprinkle, Plater, 128, Marion, Indiana.

MEXICAN Curios sell on sight. Large profits. Free particulars. Samples 10c stamps. Marquez, P.X., Apartado 1176, Mexico City.

NEW Ultra-blue signs, fast sellers, cost 3c, sells 25c, sample free. Dept. 305, Lowy, 8 West Broadway, New York.

"COLLAR-GRIP" Give-n-take flexible length. (Sample 25c.) Flexy Manufacturers, PM-62, Collinsville, Illinois.

AGENTS: Smash go prices! Santos coffee 12c lb. 4-oz. vanilla 8½c. Razor blades 10 for 8½c. 100 sticks chewing gum 12c. Christmas cards, 21 in box, 14c. 150 other bargains. Premiums. Experience unnecessary. Carnation Company, P.O. St. Louis, Mo.

BASEBALL—Enjoy earning money with Baseball. Write Baseball, Queens Village, Long Island, New York.

MAKE And sell your own products. No machinery needed. Amazing profits. Guaranteed "Chemist Approved" formulas. Catalog free. Kemico, 10-G, Park Ridge, Ill.

AGENTS Lightning seller. Amazing new hosiery replacement guaranteed against holes, snags, or runs. Hose for your own use sent with large outfit. Send hose size. Rush name, no money. Wilknet, Desk GG-37, Greenfield, Ohio.

PAST-SELLING Specialty pays big profits. New Spreading Spatula lifts pies, cakes, omelets, fish in one piece. Endorsed by housekeeping authorities. Instantly demonstrated. Send 25c for sample and quantity prices. Coradon, Dept. P, 71 West 23rd, New York.

MAGIC Roach box. Attractive sales article. Sample 10c. Nock, 1712 Valmont, New Orleans, La.

FULL Size, visible total adding machine, only \$9.95. Unlimited market. Big commission. Addomatic, Dept. Y-19, 430 N. Oakley, Chicago, Ill.

UP To 100% profit in new perfected 1940 quick action self-starting cigar lighter. No flint or friction. Lights easily in the wind. Retail 25c. Costs you \$1.75 dozen. Sample and can fluid 25c. New Method Company, Box PM-91, Bradford, Penna.

FREE Water and our concentrates make 68 products. Labels, bottles, everything supplied. Quairo, R-20030 Russell, Detroit.

MEXICAN Bird pictures. Handmade with real feathers. Sample 10c. Importer C. Staff, No. F, 8716 Lambert, Detroit, Michigan.

TIP Tennis—America's latest and most fascinating game. Skillful and healthful pastime. Millions of prospects. Retail from 25c to \$5.00. Quick sales. Liberal profits. Write today for literature. Tip Tennis Manufacturing Co., Box 426, White Plains, N. Y.

SELL Ready tied ties. Sample 25c coin or stamps. U. S. only. G. Sturm, 39 8th Ave., Passaic, N. J.

BURGLAR Gongs \$1 postpaid. Agents 50c. Sensational. Alarm Co., 35 North Ninth, Columbus, Ohio.

500% PROFIT Selling new "20-in-1" kitchen utensil. Retail 25c. Costs you \$1.00 a dozen or \$7.20 a gross. Sample 10c. New Method Co., PMM-91, Bradford, Penna.

NEW Electric outboard motor. Durable, quiet, efficient, battery driven boat power. Sell fishermen and vacationers. Low prices. Big profits. LeJay Manufacturing, 3547 LeJay Building, Minneapolis, Minn.

PROFESSIONAL Direct sales agents: Send dollar for 5 items with free samples. See, sell, prove, then get territory. Dawn-Burlite Co., Orrville, Ohio.

CALL On service stations. New item, necessity, big profits. Knipp, Long Beach, California.

OIL Paintings. Popular prices. Also lessons. Studio, 2321 North 36th, Milwaukee.

SILVERWARE Cleaned instantly. Simply dip and dry. Ekstain, tarnish, disappear. Amazing demonstration. 66% profits. NuProcess Products, Dept. 63, Aurora, Ill.

SELLS On sight, new patented cigarette snufferizing line gives better and quicker profits. Easily attached to automobile, home smoke stands, office ash trays, etc. Snuffs automatically. Butts cigarette with turn of knob. Send \$1.00 for three styles, get ash tray free, also sales plan. Moulton Snufferizing Co., Newburgh, N. Y.

WE Pay you \$5 for selling ten \$1 boxes. 50 distinctive assorted name imprinted Christmas cards. Sell \$1. You make 50c. Free samples. Cheerful Card Co., 50 White Plains, N. Y.

MAKE Money selling beautiful genuine panama hats \$2.50 each, worth \$10.00. Delicious Guava jelly 25c pound, 25 genuine Havana cigars \$1.00. Diaz Company, 418 Novena Lawton, Habana.

WINDOW-CLEANING Spray. (blue), 1c gallon. McKinley, Wayne, Penna.

EVERY Home waiting. Solder aluminum, brass, copper, tin. Sample 25c coin. Safety Supply Station, 975 Fronheiser Street, Johnstown, Pennsylvania.

KEY Checks, fobs, stamping outfits. Profitable business. Catalog. Phil Plais-tridge, Winchester, N. H.

AFTERNOONS Free! Work home! \$2,000 month reported (exceptional—fulltime). Expect surprise! National, BX1940-S, San Bernardino, California.

NEW Necessity. Millions need it. Whirlwind seller. Pays good profit. Literature free. Norris, Box 26, Brightmoor, Detroit.

AMAZING Popular safety kit selling like wildfire to homes, garages, motorists. Everybody buys. The hottest of items. Write American Distributors, Dept. 5, Cape Girardeau, Missouri.

NEW Sanitary tooth brush with two extra refills. Sells for 50c—sample 25c. Excellent repeater. Get details. Rem McChristie, 200 R, 17 William St., Newark, N. J.

QUICK Cash. Colored people buying new hair dressing, bleach cream on sight. Samples free. Valmor, 2341-AA Indiana Ave., Chicago.

SELL "Whee" liquid cleaner. It is different. Out-demonstrates competition. Wins friends. Big profits. Free sample. Cal-Western Manufacturers, 4850½ Santa Monica Boulevard, Los Angeles, California.

AGENTS: Stamping names on pocket-key protectors. Sample check with your name, address, 25c. Stamping outfits. Emblem checks, check-fobs, name plates. Hart Mfg. Co., 363 Degraw St., Brooklyn, N. Y.

BIG Money applying initials on automobiles. Easiest thing today. Free samples. Also, sideline salesmen for short order decalcomania name plates. "Ralco," 1305 Washington, Boston, Mass.

FREE Sample—Amazing cleaner; sells homes, taverns, everywhere. Big profit—fast repeater. Betco, 5007 Irving Park, Chicago.

NEW 25c Household necessity costs 2c. Linnell, University Center, Cleveland.

SUCCEED With your products. Make-sell them. Formulas, Processes. Accurate analyses. Catalog free. B. Thaxly Co., Washington, D. C.

DO You want agents for your proposition? Your ad in this space will place your message before hundreds of men seeking fast-selling products. My folder "How to Secure Agents," is filled with proof. I'll gladly send you a copy free. F. W. Johnson, Manager Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

WINDOW Sign letters. Penny each, large sizes. New styles. Absolutely beautiful. Free samples. Atlas, 7941 Halsted, Chicago.

MANUFACTURE Specialties, hire agents yourself. Big money. Free literature. Gilbert Supply, 5-P West 24th, New York.

MONOGRAMMING Automobiles real money maker. Write for samples. International Co., Box 9369, Philadelphia, Pa.

AGENTS—300% Profit selling gold leaf letters; stores and offices. Free samples. Metallic Letter Co., 438-B North Clark, Chicago.

GOOD Paying business silvering mirrors, plating autopaarts, reflectors, bicycles, bathroom fixtures by late method. Free particulars and proofs. Gunmetal Co., Ave. N, Decatur, Ill.

AGENTS—Opportunity make money; book containing 127 successful business plans; home-office; send for free introductory booklet. Elite Co., 214 Grand St., New York.

AGENTS Make big profits on food products, bargain deals. Low wholesale prices. Rush name for trial outfit offer. Ho-Ro-Co, 2810-T Dodier, St. Louis, Mo.

AGENTS—To mail our literature. Good profits. Home business. Maywood, 1105-1107 Broadway, New York.

ENGRAVED Name plates, numbers, signs, etc., easily sold, profits large. Brett Bros., Winthrop, Mass.

BIG Money applying initials on automobiles. Write for particulars and free samples. American Letter Company, Dept. 40, Dunellen, New Jersey.

RELIGIOUS Products beautifully hand carved from walnut wood. 100% profits—quick sales—steady repeat business. Earn \$5.00 to \$10.00 daily. Sales experience unnecessary. Sample 25c postpaid. Arden Company, P.O. Box 1215, Detroit, Mich.

ADD Plastics to your line. They're America's fastest selling products. See advertisement on page 136A. Ward Plastic & Rubber Co., Ferndale, Michigan.

HIGH-GRADE SALESMEN

SELL Candidates! America's largest line of political auto signs, stickers, posters, novelties. Very little competition. Ad-Nov-Co., Newton, Iowa.

SELL Firex—Automatic fire extinguisher and alarm. Endorsed by fire chiefs. Prospects everywhere—good commissions. Write for proposition. Firex Corporation, Dept. G-100, 516 South Broadway, St. Louis, Missouri.

SELL Songs, postcards, calendars. Commission. Write G. Mayer, Lake Mary, Florida.

BIG Commissions—selling to stores celluloid pricing tickets, metal shelf moulding. To restaurants, menu covers, signs. P. Pricing Press, 124 White St., New York.

NEW—Removes bugs from windshields, fenders, etc. Harmless to paint. Particulars, write. Package 25c. Ray Orton, 306 South Chelan, Wenatchee, Wash.

SELL Gasoline stations First National Neoprene shoes. 183A Essex, Boston.

TIP It, knock it over, turn it upside down. The Kant-Spill inkwell does not spill. Sold in combination with beautiful long-life fountain feed pen, writing over 200 words with one dip. Fast selling, profitable item. Sample 60 cents. Full information return mail. Haarer & Company, Box 389 MO, Lansing, Michigan.

DISTRIBUTORS—Salesmen, new model envelope sealer, sells on demonstration at \$2.50. Seals 40 a minute. Kendall Sealer Company, East Jaffrey, New Hampshire.

SENSATIONAL Quick-cash opportunity. My route building plan gives you chance for good steady income. Real future. Handle regular route local stores. Collect, deliver orders for famous 5c—10c counter display goods. Nationally advertised in 120 magazines and radio. Show merchants proven plan for beating competition and increasing sales, profits. Experience unnecessary. Use home as headquarters. Chance to operate Silver Fleet service truck. Facts free. World's Products Co., Dept. 10-A, Spencer, Ind.

ADVERTISING Book matches—World's largest manufacturer of union label book matches. Fast selling line. Large sales producing kit. Sample matches, complete cut catalog. 9 color combinations makes selling easy. Commission in advance. Superior Match Co., 7530 Greenwood, Dept. M-7, Chicago.

IT'S Hot! Big repeater with plenty immediate and repeat commissions. No investment. Sells to every type retail dealer and service station. Sales kit free. Hurry! Universal, 2222 Diversey, Dept. C57, Chicago.

MAKE Big money! Demonstrate automatic electric hot dog cooker. Sells on sight. Eating places, taverns, drug stores wild about it. Write for big profit deal. Wienie Chef, 2301 W. Hubbard, Dept. U-18, Chicago.

ADVERTISING Book matches—World's largest "direct selling" book match factory offers advance cash earnings calling on every type of business. Experience unnecessary; full, part time. Low prices for high quality; quick deliveries, help you get orders. Good repeat profits. Free kit, instructions. Match Corp. of America, 3343 West 48th Pl., Dept. E-7, Chicago.

EVERY Business must buy printing, advertising specialties, book matches, etc. Take orders for the pioneer line—725 necessity items at 50% price saving. Free deals. 40% advanced commission, bonus. Experience unnecessary. Outfit free. Willens, 2130 Gladys, Dept. XV, Chicago.

SALESMEN Making \$20 to \$50 daily demonstrating new air circulating fans. All business places hot prospects. General Fan Company, Peru, Ind.

SELL Printing at cut prices. 2,000 business cards \$1.50; 1,000 envelopes or state-ments, etc. \$1.75; 25 printed sales books \$1.50; 1,000 process embossed cards \$1.50; 2,000 two-color labels, free holder \$1.50; 2,500 printed handbills \$1.75. One-third comm. Free outfit. Bargain Prtg. Co., 189-F W. Madison, Chicago.

COMPLETE Line everyday business necessities—Over 2000 items at big money saving prices. Experience unnecessary. Samples free. Commissions advanced daily. Northwestern, 625-BG Jackson, Chicago.

FREE Trial to customers. Sells itself! Revolutionary loud speaking inter-communication system. Talk privately, back and forth, to one or any number of stations, even 2,000 feet away. Any station originates calls. One electrical connection. No servicing. Easily installed. Guaranteed. Technical experience unnecessary. Two-minute demonstration. Thousands prospects, factories, offices, automobile dealers, lumber yards, restaurants, etc. We carry the accounts. New low price. Men earning high as \$150 week. Protected territory available. Free demonstrator offer. Inter Communication System of America, 2440 Lincoln Ave., Dept. 308, Chicago.

SALESMEN, Distributors. We have something sensational. Big money maker. Come on you top notchers. Electric Screen Co., 1409 N. 54 St., Milwaukee, Wis.

PROFITABLE. Permanent business. building a store route for Sig's 10c Insect and Rodent killers. Attractive displays. Steady, repeat business. Morco, 920C Ohio, Chicago.

AMAZING Patented screw-holding screw drivers! Factories, garages, service stations, electricians, mechanics, public utilities, stores buy quantities; big profits, quick repeats, exclusive territories. Free trial! Mfg'r, 6032 Journal Bldg., Boston, Mass.

BOOK Matches, wall calendars. Lowest prices. Big cash commissions. Outfits free. Mention which. Gem Match, 82-J West Washington, Chicago.

MAKE \$300 Profit next month on \$425 sales. America's finest line of automatic fire protection. Restricted territories. PyroTecTor, Bradley Beach, N. J.

ONLY Two sales per day makes over \$1200.00 monthly profits. Auto tools. Every mechanic a prospect. 95% virgin. \$50.00 sales makes \$36.00 profits. New. Proven. Protected territory to producers. Year around demand. Messco, Beaver City, Neb.

LIQUIDATING! \$75,000.00 Wholesale stock—greeting cards, novelties, Christmas merchandise! Catalog free! Ellico, 436 North Wells, Chicago.

CALENDARS All sizes—Orders are being placed now for 1941 calendars, advertising fans and novelties. Free samples—get started now and book those early orders. Fleming Calendar Co., 6543 Cottage Grove, Chicago.

NEW Specialty—Sells every business and professional man. Four \$15 sales daily pay \$280 weekly. Farrell cleared over \$1,000.00 monthly. Write F. E. Armstrong, President, Dept. PM, Mobile, Ala.

DISTRIBUTORS, Crew managers, organizers of agents, send quick for news of amazingly-seasonable device for traveling autoists. Fifty cents retail or more value. Quick easy seller. Light, permanent. Immense commissions. Write or wire for details. Also can use few lone salesmen in unoccupied districts. Act promptly. Nicholas Company, 1137 Cottage St., Philadelphia, Penna.

BLADES—Big profits. Best quality. Factory prices. Postpaid. Ace Blades, Buffalo, N. Y.

A REAL Future for you with Red Comet fire control products. Low prices. Proved seven years. Splendid sales outfit free. Some good territory open. Exclusive. Write quick. 704 Red Comet Building, Littleton, Colorado.

EXCELLENT Opportunity selling our complete line of brushes, largest commissions. Write for sales plan. Wire Grip Sanitary Brush Company, 2300 5th Ave., New York.

EDUCATIONAL AND INSTRUCTION

\$105-\$175 MONTH. Men-women. Get U. S. government jobs. Prepare immediately for examinations. List positions—full particulars free. Write today. Franklin Institute, Dept. F3, Rochester, N. Y.

LOOK! Acquire emotional stability! Nervousness, fear, bashfulness—afflicted? Free, valuable information. John Englund, Ironwood, Mich.

WATCH Repairing is steady profitable work. Experts usually in demand. You can learn watchmaking trade at home, spare time. New original instruction system. Script engraving course included. Write for free details today! Nelson Co., 500 Sherman, Dept. G-2061, Chicago.

BECOME Practical scientific investigator. Modern illustrated course. Thorough training by former agent U. S. secret service. Particulars free. International Secret Service Institute, PM-70, Hoboken, N. J.

AIR Conditioning—Electric refrigeration. Rapid growth creates big demand for trained men. Earn up to \$35-\$50 weekly. Write for free facts. Utilities Engineering Institute, 404 North Wells, Dept. 107, Chicago.

LEARN Photo offset plate making. Get into printing industry's fastest growing field. Color and black and white plates. Easily, quickly learned. Home or residence training. Details free. Tasope! Photo Litho School, Aurora, Mo.

LEARN Auto finance and personal loan business. Practical, inexpensive home course teaches all phases, quickly. Nebraska Finance Co., Lincoln, Nebraska.

WELDING—Electric arc. Learn quickly by actual practice at Hobart Welding School. Individual instruction at bare cost of materials used. 50c in stamps brings valuable welding lessons post paid and full particulars. Hobart Welding School, Box M-7404, Troy, Ohio.

ELECTRICITY Simplified with practical training. Low cost. Write Sunbury Engineering Works, Box 129, Sunbury, Penna.

AIR Conditioning—Electric refrigeration. Course \$14. Information free. Keystone Technical Bureau, Box 412, Scranton, Penna.

GOVERNMENT Jobs, Men, women. Start \$105-\$175 month. Pay for course after appointment. National Institute, Dept. AB, Creston, Iowa.

NEW! Mental multiplication—complete course 25c. Penmanship course 25c. Prudential, 331-T Hopkinson, Brooklyn, New York.

"HOW To Break and Train Horses"—A book every farmer and horseman should have. It is free; no obligation. Simply address Beery School of Horsemanship, Dept. 1107, Pleasant Hill, Ohio.

HOME Study for degree. Psychology, Metaphysics, Philosophy, Bible. Free information. College of Universal Truth, 20-B East Jackson, Chicago.

YOUNG Men—Learn Linotype (typesetting). Booklet "X" free. Mergenthaler School, 244 West 23rd, New York.

CLAIM Adjusting. Excellent pay. Investigate tragic accidents. Free; outfit fraudulent claimants. Burns School, 311 Morewood, Pittsburgh, Penna.

BIG Money. Enroll now. Learn in a few weeks decorating, paperhanging, graining, marbling, sign and pictorial painting. Catalog free. Chicago Painting School, 102 West Lake St., Chicago, Ill.

TELEGRAPHY Taught thoroughly. Railroad retirement act creating opportunities for new operators. Expenses low. Catalog free. Dodge's Institute, Hiatt Ave., Valparaiso, Ind.

MASSAGE, Hydrotherapy, dietetics, drugless therapeutics, chiropody, taught by mail. Evans Correspondence School, Montgomery, Ala.

LEARN Auto mechanics, body, repairing, welding electricity, refrigeration. Diesel. Steven's, 2008A Main, Kansas City, Mo.

SECRET Investigation. Experience unnecessary. Detective particulars free. George Wagner, M-2640 Broadway, N. Y.

PLAYS, STORIES, MANUSCRIPTS

STORIES Revised, typewritten; placed on market. Hursh, Box P-1913, Harrisburg, Penna.

CARTOONING, COMMERCIAL ART, SHOWCARD WRITING, SIGN PAINTING

CARTOONISTS—Artists. We pay cash for your work. Write for bulletin. Fidelity Company, Inc., Syracuse, Ohio.

CARTOONING Course—30 illustrated lessons, over 500 sketches, drawing paper, pens and pencils. \$1.00 complete postpaid. Montes Art Studio, Box 445-M, Pasadena, Calif.

PAINT Signs with lettering patterns. Free literature. Sample alphabet 5c. Display Letters, Box 28-M, Ft. Hamilton Station, Brooklyn, N. Y.

TRICK Chalk stunts. Catalog 10c. Balda, The Cartoonist, Oshkosh, Wis.

PEN And ink drawings. Let us draw your advertising and catalogue illustrations, from photos, copies or objects. Best work and fair prices. Heraldic Studios, 1914P Oakdale Avenue, Chicago, Ill.

AMATEUR Cartoonists. Earn cash at home, copying advertising cartoons. Ad-Service, Argyle, Wis.

ADVERTISING AGENCIES, LETTER WRITERS, FOR ADVERTISERS

MAIL-ORDER Ad reaching over 1,000,000 families throughout United States \$14.00 inch. Newspaper, magazine, rateguide—free. Chicago Advertising Agency, 20-P West Jackson, Chicago.

LEARN Advertising at home. Easy practical plan. No text books. Common school education sufficient. Interesting booklet and requirements free. Page-Davis School of Advertising, 3601 Michigan Avenue, Dept. 3439, Chicago.

ADVERTISE: 24 Words, 149 newspapers \$6.50. Lists free. Advertising Bureau, 4515-C Cottage Grove, Chicago.

RESULT \$? 27 Words, 280 pulling, national magazines, \$5.00, Inch \$7.50. Samples, 25c. Piersimoni, 1231 Spofford, New York City.

ADVERTISING Placed all magazines, newspapers, radio. Lowest rates. Free service. 54 page rate book free. Baker Advertising Agency, A-189 West Madison, Chicago. Successors to Ankrum. Established 28 years.

FREE—New Advertisers Rate Guide, 44 pages. Includes everything. Lowest rates. E. H. Brown Advertising Agency, 140 S. Dearborn, Chicago.

BUSINESS SERVICE

FREE Samples. Hundreds designs. Gummed picture and business labels, metal signs, office forms. Arrowprint, Dept. 7BPM, Waterbury, Connecticut.

CHICAGO (Downtown) mail address \$1 monthly. Your mail reforwarded daily. General Business, 56 West Washington; (established 1919.)

WASHINGTON, D. C., mail address and reforwarding service. Hawkins Mail Service, 908 Fourteenth.

ANY Unusual article. Address where to buy from manufacturers-wholesaler, 25c. Tri-State Buyers Service, 103 Barker Street, Jamestown, New York.

HOLLYWOOD Mail address \$1 monthly. Reforwarding daily. Hollywood Mailers, 763 North Seward, Hollywood, Calif.

ADVISORY SERVICE

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Vol. 74

JULY, 1940

No. 1

SHARPSHOOTING at the ATOM

By Dr. E. U. Condon

Associate Director, Westinghouse Research Laboratories

East Pittsburgh
RESearch physicists in universities and in at least one large industrial laboratory are busy smashing the atom. Why? What for? And just what does it mean to smash the atom? And how is it done?

Ten years ago we did not even know what basic parts made up an atom. Chemists knew that all matter was made of some ninety chemically distinct kinds of atoms. Physicists knew these atoms were made of electrified particles; that there was a heavy central part, called the nucleus and charged positively, surrounded by little particles of negative electricity, called electrons. Different elements are known to be made of atoms which differ with regard to the number of electrons in the atom. Thus the hydrogen atom

Dr. John A. Hipple, Jr., assembles vacuum tube of spherical mass spectrometer designed to sort molecules and atoms so scientists may have definite target at which to direct "bullets" of atom-smashing machines



JULY, 1940

Westinghouse Research Field

K419

Westinghouse.



Above, assembling porcelain insulating columns which support giant electrode at top of sixty-five foot "atom-smasher." Below, Dr. William H. Wells measuring voltage of giant machine with electroscope. This instrument calibrates voltage by measuring gamma rays emitted by fluorine under bombardment by protons, the hearts of hydrogen. Right, details of Westinghouse atom bombarding machine



contains one electron, the iron atom contains twenty-six, the lead atom eighty-two, the list ending with the uranium atom having ninety-two electrons.

Eight years ago a new fundamental building block of matter was discovered, the neutron. It was given this name since it is electrically neutral. It has about the same mass or weight as a single hydrogen atom. It is now known that the central heavy nucleus of all atoms (except the simplest, hydrogen) is a little aggregate of protons and neutrons stuck together. The proton is the smallest unit of positive electricity we know—having the same electric charge as an electron, but weighing 1840 times as much. We are



now quite sure that all matter is made up of these three things: Electrons, negatively charged, small weight; protons, same charge, 1840 times electron weight; neutrons, no electric charge, about same weight as proton.

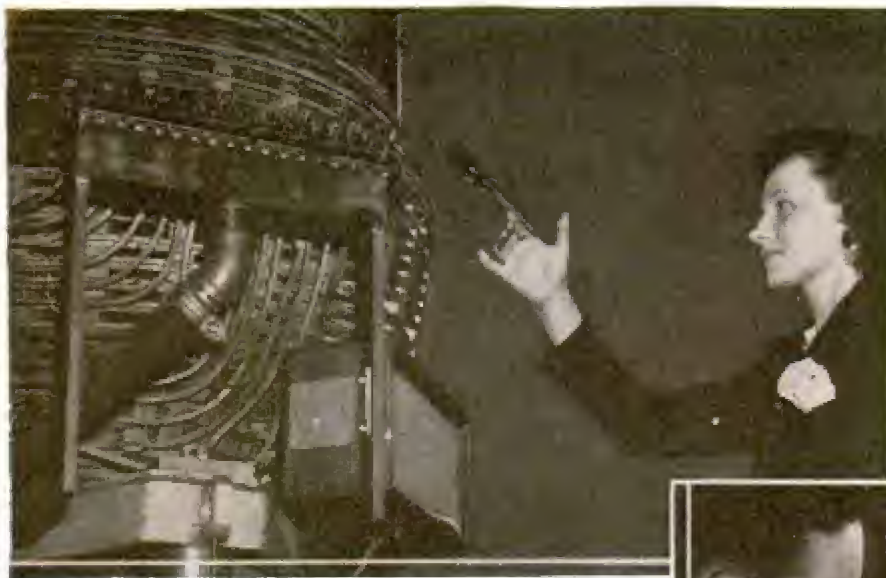
We also know from the many researches done before 1930 a great deal about the behavior of the electrons outside the nucleus. The problem which confronts the "atom-smasher" is to find out how the protons and neutrons hang together inside the tiny nucleus.

Atoms are so small that in solid bodies they run about one hundred million to the inch. The nucleus of an atom is a little central speck ten thousand times smaller. But here there reside extremely great forces—much stronger forces than electrical forces, forces which seem not to be electrical in nature, but of an altogether different type not known before. They attract the particles of the nucleus tightly together but become extremely weak as soon as a particle gets a little way out of the nucleus. They are called short-range forces, in contrast to electrical forces which act over large distances, even



Top, segment of forty-foot vacuum tube which, when completely exhausted, contains only one seven-hundred-and-sixty-millionths as many air molecules as are in normal atmosphere. Center, testing tube for leaks. Bottom, adjusting target holder at bottom of vacuum tube. Nickel-size targets of elements are placed in holder to be bombarded with sub-atomic particles traveling between 30,000,000 and 100,000,000 miles an hour



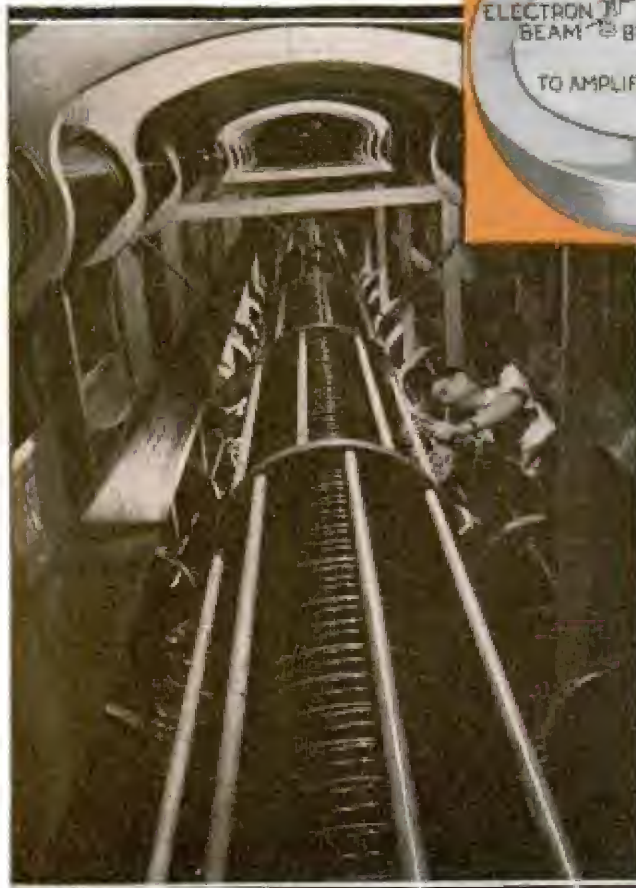


Left, screwdriver held in space by magnetic lines of force radiating from mass spectrometer. Below, chamber used in studying or photographing sub-atomic collisions. Below, left, sketch shows paths followed by particles of three different masses in mass spectrometer (spectrograph). Heaviest particles travel slowest, so follow inside "track." Bottom, section of giant vacuum tube

though these, too, get weak as the distance between charged particles is increased.

These forces make the atoms such very stable things that all the centuries-long efforts of alchemists of the Middle Ages down to those of modern chemists failed to change one kind into another. Men spent centuries trying to change lead into gold—they failed in that but their efforts created the science of chemistry of inestimably greater value to human life than if all the lead in the world were turned to gold.

Nowadays we are not so sure just how life can be



made better through application of the new knowledge coming from the smashing of atoms, but we know that knowledge of such fundamental importance is sure to

find some important use. Already we see indications of uses of the new knowledge. We now know how to prepare radioactive forms of nearly every kind of atom. That is, one can make phosphorus, or iron, or sodium, or almost any other substance, in a form which has properties like natural radium. These atoms have too much energy to be stable and so after a time they get rid of it by shooting out a high-speed electron, or perhaps a very penetrating X-ray. These new artificial radioactive substances are not merely substitutes for radium—they have special properties of their own which enable us to go beyond radium in using them in medicine. For example, radio-phosphorus can be taken di-

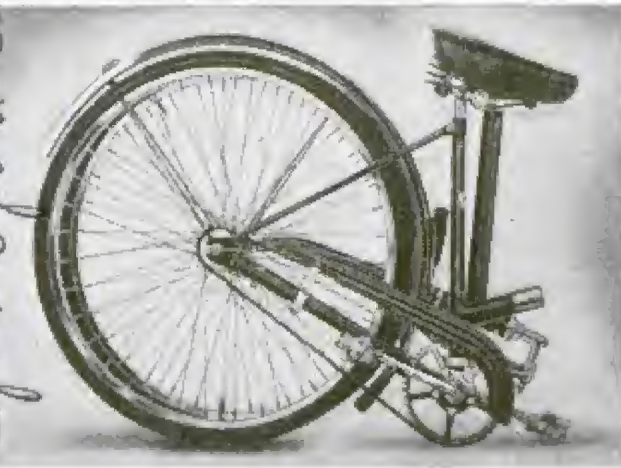
K 417

The Westfield High School

K 471

Bicycle Folds in Two Parts Assembling without Tools

Westfield, Mass



Top, assembling two halves with special joint and wing nuts; below, the two parts folded for carrying

Held together by a patented joint and wing nuts, a folding bicycle for holiday jaunts can be stowed away compactly in the trunk of an automobile. Lacking the usual horizontal crossbar, it has adjustable seat and handle bars so that one model accommodates man, woman or child, and the bar connecting front and rear sections comes apart for packing. It takes but fifteen seconds to fold up or assemble the bicycle, no tools being required. The handle bars also fold to the width of the bicycle. Besides its use on auto trips, it may be carried on small yachts for land excursions, and operators of truck fleets may stow the bike on trucks for emergency uses.

More than ninety-three per cent of the drivers in fatal automobile accidents in 1939 were men, less than seven per cent were women—but there is no way to determine the total mileage rolled up in a year by men and women drivers.

Travelers Bureau
Hartford, Conn.

rectly into the body, as a phosphate drink. The radiations it emits are known to have a beneficial effect in the treatment of leukemia, a cancerous disease of the white blood cells. It would be fatal to give patients a similar radium treatment.

Radioactive atoms can be used as tracers. If we want to trace what happens to a particular element in our food its course in the body can be followed with an electrical detecting apparatus because of the radium-like rays it sends out. This can be done while using such minute amounts that there is no effect whatever produced in the living cells by the radioactivity. Already valuable things are being learned about the thyroid gland by using radio-iodine at the University of California, and about anemia by using radio-iron at the University of Rochester.

To smash an atom really means to produce some violent rearrangement in the tiny central nucleus, perhaps knocking out some of its parts. This is a lot harder than merely to knock loose some of the outer electrons—this happens quite easily and goes on, for example, in every neon advertising sign. Since the forces holding the nucleus together are so very strong it is necessary to hit it very hard. This is done by striking with some tiny atomic projectile like the proton, which has been gotten up to great speed artificially, with high-voltage apparatus.

There are two main types of apparatus used for getting projectile protons up to speed. One is the cyclotron, for the invention of which Prof. E. O. Lawrence of the University of California received the 1939 Nobel Prize in Physics. The other is the belt-type electrostatic generator developed by Prof. R. J. Van de Graaf of Massachusetts Institute of Technology. Both types have their respective advantages and disadvantages so they are more complementary than competitive. The equipment of the Westinghouse Research Laboratories is of the latter type.

In it an electrode is insulated on a tower of porcelain bushings in the center of a large tank of compressed air and is charged up by bringing electricity to it on a rapidly running belt. Its voltage builds up until a spark passes somewhere. Without pumping up the tank it goes to one and three-tenths million volts, and when the air pressure is about sixty pounds per square inch

(Continued to page 143A)

Portable Typewriter Table Folds into Carrying Case



Standing on three well braced legs, typewriter case becomes table when opened. Circle, legs being folded under cover

For the busy traveler who wants his office wherever he hangs his hat, there is a combination typewriter carrying case and table. Folded under a second cover are legs, permanently fastened and adjustable for height, that open into a sturdy tripod to support the typewriter. Ample space is provided for holding papers, and when closed the case contains a compartment to store finished work.

Electric Jolt Puts Fish to Sleep for Handling at Hatchery

Shock treatment is the latest method of putting fish to sleep so that they may be handled without harm at fisheries. A 110-volt jolt from the nearest electric-light socket has an anesthetic effect on the fish,

and while they are in a stupor they can be counted, weighed, tagged or subjected to any other treatment and then returned to the water apparently without ill effects. Two wire-cloth screens are placed, two feet apart, in the hatchery trough and each is connected to a wire from the electric circuit. A 110-volt shock for five to seven seconds stunned eighty-eight six-inch brook trout for about two minutes. The method has been applied also to taking a fish census in a stream, blocking off a section of the stream with seines and then moving a portable electrode up and down.

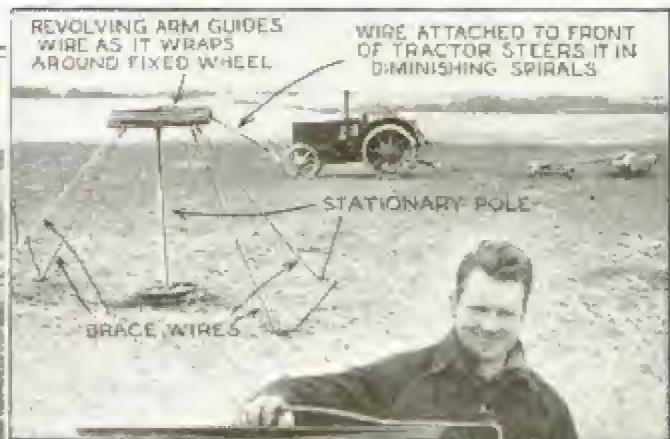
Window with Roll Screen Swings for Washing

Screen frames are eliminated from house windows by a patented window and roller screen combination. When the window is opened at the top or bottom, a screen appears automatically to fill the opening; it winds out of sight on a concealed roller when you close the window. Thus none of the daylight is cut off by the screen while the window remains shut. Its reversible feature permits the sash to be turned "inside out" for easy washing of inside and outside surfaces.



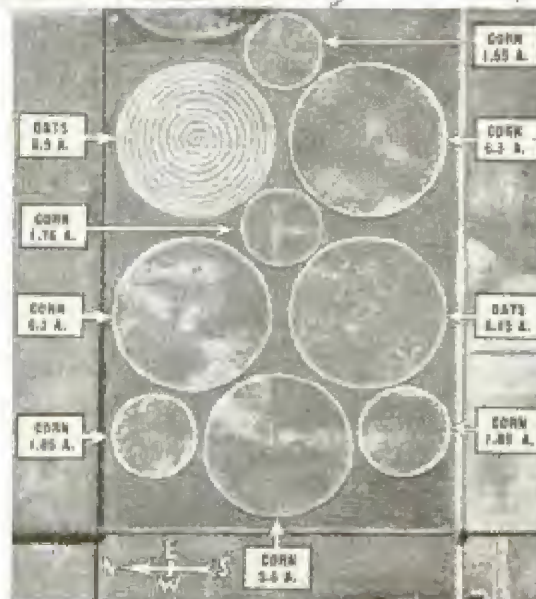
Left, screens unroll to cover space as windows open. Turning window, right, for washing glass from inside

K 56 Chicago Tribune Photo Dept. Chicago Driverless Tractor Plants Crops in Spirals



Riding a tractor day after day, plowing and planting row after row around his fields, didn't appeal to a young agricultural college graduate so he invented an easier way. A driverless tractor now circles his fields, preparing the soil and planting the crops in diminishing spiral rows like the grooves on a phonograph record.

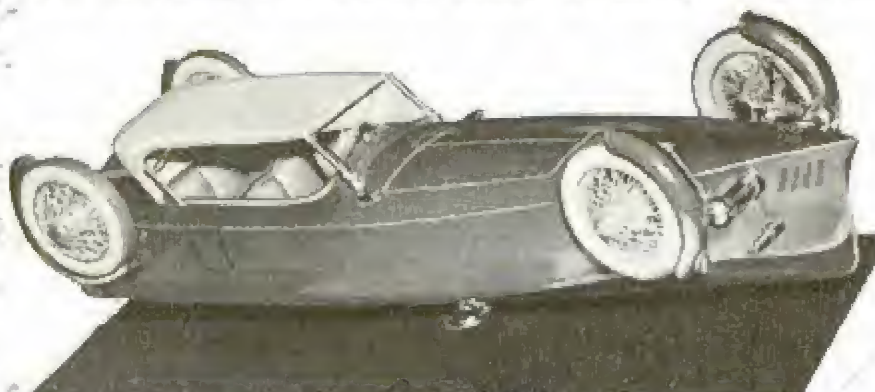
The inventive farmer is Frank W. Andrew of Palmyra, Ill. In a rectangular field of ~~eighty-eight~~ acres his largest plot is a six and three-tenths-acre circle of corn. The tractor traveled eight miles in circles to plant one plot. In the "crevices" between circular plots, soybeans were planted. To



Above is the tractor with steering arm controlled by cable as it winds around fixed wheel. Left, aerial map of circular plots

guide the pilotless tractor, a barrel or fixed wheel is staked at the center of the field, and around it winds a cable attached to a steering arm on the front of the tractor. As the cable winds up on the drum, it keeps pulling the tractor toward the center. When it reaches the center of the field, the machine stops automatically. Once the tractor has been started on its circular course, it runs for hours unattended. Mr. Andrew has applied for a patent on his method.

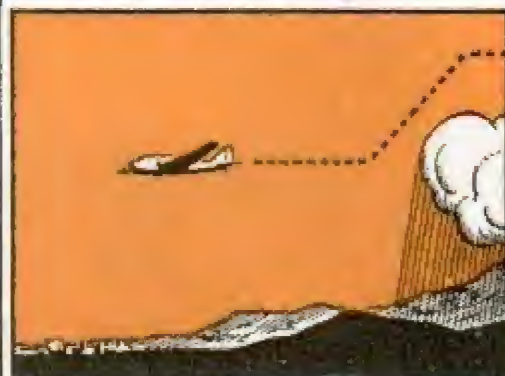
K 456 Sea-Going Auto to Lift Wheels When It Takes to Water



Scale model of the amphibian speedboat, on exhibit at Miami; by swinging its wheels down to the ground it becomes a sport-type automobile

With the lines of a speedboat but with wheels for "shore duty," a sea-faring automobile has been designed by an inventor at Miami, Fla. The scale model, already completed, shows the retractable wheels swung up above the water line as if in readiness for a salt-water cruise.

DETOUR!-



Left, lining up radio direction finder to triangulate weather balloon signals and figure wind direction and speed. Lower left, TWA dispatcher plans route to dodge storm. Right, recording radio conversation between plane and terminal



Photo from TWA

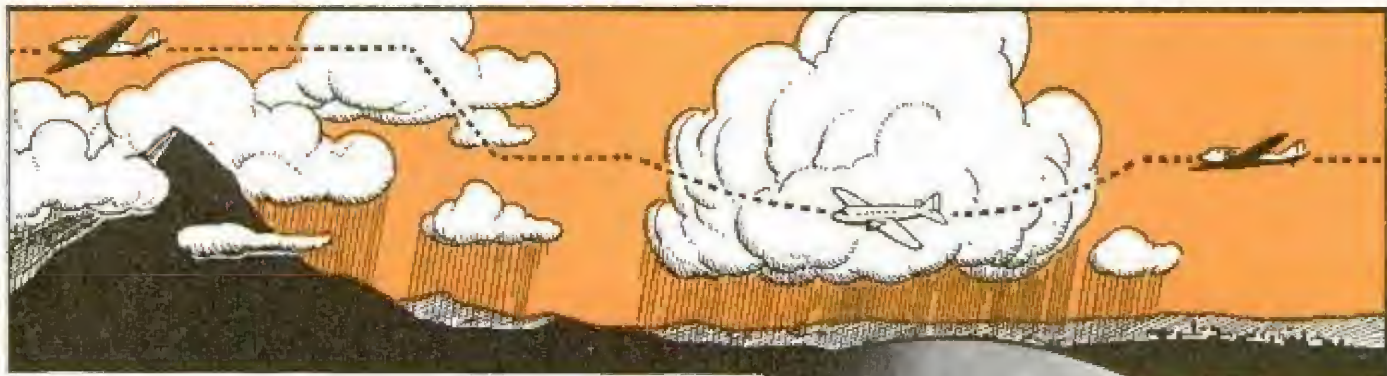
THIS year when you fly from coast to coast your pilot probably will land you on schedule even though he takes time out to dodge weather that he once plowed straight into. Your air liner won't leave the ground until weather conditions ahead are right, yet your chances of arriving "on the dot" are better than ever.

in aviation meteorology enable pilots to take advantage of the weather instead of trying to fly in spite of it. More and better weather reports and better ability to forecast the exact weather aloft have made the airways more comfortable.

"A few years ago," explains Dr. C. E. Buell, American Airlines' chief meteorol

Long Island City, N.Y.

BAD WEATHER ALOFT



ogist, "we often canceled a trip because the weather was questionable. We didn't know what it was like aloft but we did know that the next field was closed in.

"Under the same circumstances today we are apt to fly on schedule or take off after a short delay. Better weather information tells us flying conditions aloft are perfect and that it will be clear at the next field by the time the plane arrives there.

"In the past we sometimes suspected a pilot



In circle, assembling the tiny radio transmitter to send weather data automatically from the raob balloon; batteries are at right. Below, a TWA mechanic inspects the radio lead-in strut on a sky liner

would encounter ice so we canceled the flight. Other times a pilot ran into ice we hadn't anticipated. Now we can tell quite accurately when temperature and humidity will create an icing condition, its intensity and altitude, the area it covers and the speed at which it is moving. The result is that we can dodge it. If the ice is between scheduled stops the pilot takes off, flies above or below it, and lands ahead of it. If the icing condition is drifting toward our next stop we delay the trip until the ice will have passed beyond by the time the plane arrives there. Today



Dispatcher, left, signals pilot to delay takeoff eight minutes to let storm pass next landing field. Weather dials at control tower, right, show wind speed and direction, temperature and barometric pressure

de-icing gear is carried merely as emergency equipment."

As an additional precaution no plane takes off if there is a suspicion that ice or frost has gathered on it while on the ground. In cold weather a plane wears canvas hoods on its wings that are yanked off just as the plane starts rolling down the runway.

Most bad weather is close to the ground and planes fly above it. Passengers sometimes fly clear across the continent and see nothing but clouds below. Average flight altitudes are higher than a few years ago yet no air liners climb to the extreme altitudes to which they were sometimes forced in the past. Twelve thousand feet is the maximum operating altitude today although it used to be that a pilot sometimes carried passengers to 18,000 feet or more.

Each flight is a separate problem and the pilot, flight superintendent and meteorologist have a dozen things to consider at their pre-flight conference. Clouds are no handicap these days, but a low ceiling under the clouds is something else. If the ceiling or visibility at the next scheduled stop is below the minimum specified in the regulations a postponement is ordered. Each field has its own minimum ceiling and visibility restrictions and each is different

for night and day and for takeoff and landing. A 300-foot ceiling and three miles of visibility may be required for a night landing at one field yet at another, in



Mechanic checks the rudder of a TWA sky-sleeper in one of hundreds of tests made between flights



mountain country, an air liner can't be scheduled to land without at least an 8,000-foot ceiling.

Passenger comfort demands that the plane fly in smooth air, so the pilot selects the altitude at which turbulence will be least, even though there is a head wind instead of a tail wind at that altitude. Hail and thunder storms have to be avoided because of the rough air and because the electrical phenomena may be disquieting to the passengers. A general rainstorm is no longer a deterrent to flying, and a flight through rain clouds "on instruments" is smoothest of all because the rain drops screen the turbulence out of the air.

After the flight plan is worked out, the rate of change in the weather is studied. The forecast must show the weather will be steady or improving.

Not so long ago a meteorologist was satisfied if he could anticipate the exact weather twelve hours in advance. Now, details of flight conditions are being demanded twenty-four and thirty-six hours in advance and the meteorologists are supplying them. The air-line traffic departments need to be warned long in advance if parts of a flight will have to be canceled because of zero-zero weather, so that arrangements can be made to carry the passengers by train through the storm area.

Part of the reason for this increased forecasting ability is the

(Continued to page 141A)



Top, TWA sleeper rides smooth air over clouds. Right, testing pitot tubes and air-speed dial. Below, airport anemometer

"F-M" Radio Subdues Static in Artificial Lightning Test



Scrawling lines formed by million-volt flash of lightning when frequency-modulation receiver undergoes listening test

To compare the new static-free radio, called frequency modulation, with reception by the amplitude-modulation system in general use today, General Electric engineers produced made-to-order lightning storms that hiss, snap and crackle under a million-volt, three-phase charge that creates a visible corona along the strung wires. With the radio set tuned to standard amplitude modulation, the program music was completely lost in roars from the electrical display picked up and amplified through the loud speaker. Then the knob was twisted over to frequency modulation, and all the noises of man-made static were reduced to a scarcely perceptible buzz and the music flowed from the set with clearness and fidelity.

Nylon Crimped Like Wool Is Mothproof and Elastic

Nylon, the synthetic fiber that has already begun to compete with silk as a hosiery fabric, may soon

go into competition with natural wool. The du Pont company which developed nylon has obtained a patent on a method of crimping nylon fibers so that they resemble wool and have nearly the same heat-insulating qualities. Nylon is made from such common raw materials as water, coal and air, by complex chemical processes. It is claimed that the new wool-like nylon, which will not be ready for commercial production until new manufacturing tools are designed and built, is superior in strength, heat stability, elasticity, dyeing characteristics, immunity to injury by cleaning fluids, and is mothproof.

Low-Cost Pusher Plane Has Seat for Two

Two passengers will be seated side by side instead of tandem, in the 1940 Sky Car designed by William Stout to meet the demand of private flyers for a low-price airplane. With its eighty-five horsepower engine mounted in pusher fashion, the ship will fly 130 miles per hour or better. It lands nose down without need of stalling and has multiple safety landing gears.



Examining model of low-priced 1940 Sky Car that is pushed by propeller at rear and has seat for two passengers side by side

K 469. The Grumman Co. Both pages L.T. healed!

Navy Sky Fighter Beats Seven Miles a Minute

Called the "Skyrocket" for its outstanding climbing ability, a Grumman fighting plane built for the U. S. Navy is understood to have passed 450 miles an hour in test flights. Although its specifications are secret, claims are made that it can outclimb any other airplane by virtue of the greatest horsepower per pound ever built into a plane. Twin-motored, it has



Official U. S. Navy Photos

With two powerful engines, this Grumman fighter is said to outclimb any other plane

a short body and twin rudders, offering high maneuverability. It is a single-seat ship, heavily armed, able to pour uninterrupted fire from its nose. With its large fuel capacity it can convoy bombers on long-range missions. The engines are air-cooled.

Planting Gun "Shoots" Seeds from Magazine into Ground

Gardening is saved some of its back-breaking work by a planting gun that "shoots" the seeds underground. Its operator stands upright, fills the container with seeds and then releases the desired number by pressing a trigger. The gun also can be used for watering roots and for fertilizing.



Seeds are placed in container at top, then shot into ground with trigger. No stooping is necessary

Germ-Killing Elements in Earth Promise to Conquer Disease

Complete conquest of disease may be the eventual result of the discovery by two New Jersey scientists, Drs. Selman A. Waksman and H. Boyd Woodruff, that the soil in gardens and fields contains germs capable of killing disease germs of the gram-negative group. This group includes germs causing typhoid fever, dysentery and cholera. Another scientist, Dr. Rene Dubos, recently reported that disease germs of the gram-positive group—this includes pneumonia and diphtheria germs and the staphylococci—can be killed by chemicals extracted from soil germs. Scientists felt these discoveries heralded triumph over germ-caused disease, yet it may take years to apply the knowledge.

new Brunswick 29(8)

Handwritten notes on the right margin:
 Hagerstrom
 Metal craft
 Studio, 1243 Chicago Ave
 Evanston Ill

Handwritten notes at the bottom:
 Agricultural
 Extension Station

K 442

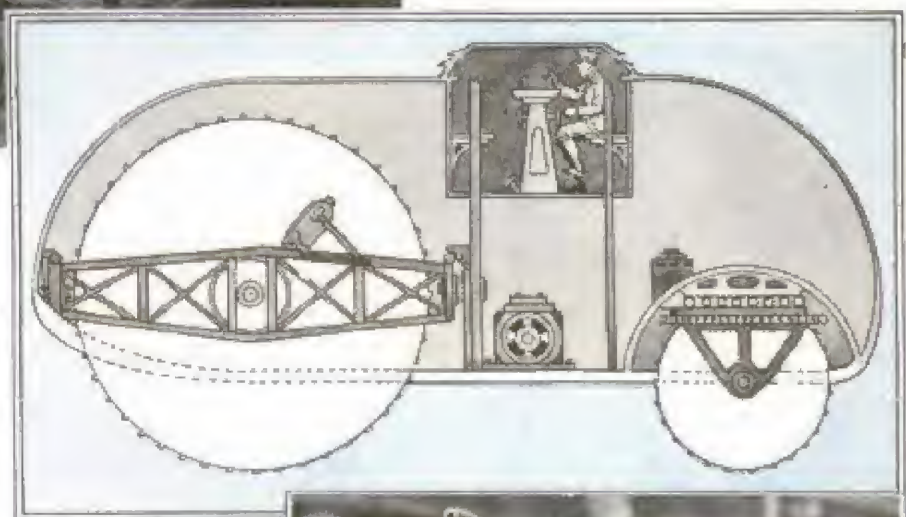
Barge on Wheels Planned to Open Wilderness

Generation 11456932

James G. Old, Bernard W. Cameron, & Patricia R. Old.
 Gen. P. Old, 11456932, Cameron, Gen. P. Old, Canada



At the left is the military adaptation of the drum-wheeled amphibian tank; the freight carrier is shown on the cover of this issue, and at the bottom is a photograph of the scale model showing how its front wheel swivels to accommodate itself to uneven ground. In center, a sectional diagram of the three-wheel "barge"



Up in the northern Canadian wilderness they need tough vehicles to tote heavy freight to the mines and haul ore out. Even tractor treads may be fouled on a rock, mired in swampland or caught in treacherous ice. Two Canadian inventors have just patented an amphibian tank designed to travel where no road exists, over swamp, snow, ice, water or rugged hillside. An adaptation of the plan would make it a rolling military fort. Its bargelike body, thirty-five feet long and eleven feet wide, would weigh about twenty tons and carry an eighteen-ton load; afloat, it would displace 12,000 cubic feet of water. Breaking from the two-rut tradition that dates from days of chariots, the plan calls for three gigantic wheels, the front wheel being twelve feet high by six feet wide; the other two, mounted for steering beneath two swivels, each six feet high and three feet wide. Each watertight drumlike wheel is separately driven, the front wheel having a forty-horsepower electric motor on each side, and each rear wheel having a twenty-five-horsepower motor. Steering controls at both ends permit driving in either di-



rection. The front wheel rides in a cradle allowing it to wobble with inequalities of the road, the three-point body suspension relieving torque; this cradle is controlled with a system of oil pumps and valves so that it can be tilted at will and permit a shift in the center of gravity if needed while negotiating steep slopes sideways. An electric circular saw could be mounted on an extensible arm to cut down trees in the path of the tank, and a crane on top could hoist obstacles out of the way. Power would be furnished by a 200-horsepower Diesel.

Model Fire Engine Shows How to Fight a Fire



Built by the firemen themselves, this working model of a fire truck of the Canterbury squad—the original pours 700 gallons a minute—is used by English fire fighters to train their wartime recruits

British firemen put out model fires with model fire engines in training men for the auxiliary fire services of wartime. Members of the Canterbury squad built the

miniature engine, copying it after their own truck which delivers 700 gallons of water a minute. The working model operates under ordinary domestic tap pressure.

Gas Heaters Given "Third Degree" to Make Them Safe

Stoves, heaters and other gas appliances undergo rigorous tests for safety and efficiency before being given the stamp of approval by the new testing laboratories of the American Gas Association in Los Angeles, Calif. After the appliance has burned in a sealed testing chamber, a sample of the air is taken and examined to determine its percentage of carbon monoxide. If the air contains 1/500 per cent, or more, of the deadly gas, approval is withheld from the offending unit.

Only 6.8 per cent of the radiation from a forty-watt incandescent lamp consists of visible light.



Air taken from test chamber is analyzed for carbon monoxide, which must be less than 1/500 per cent if gas heater is to be approved

120-Foot Artificial Cascade Cools Fair Exhibit



At left is a drawing of the 120-foot cascade in the Westinghouse courtyard at the New York world's fair, as it appears at night. It consists of fifteen eight-foot drops arranged so that water is sucked back into reservoir and spectators are protected from mist. Below, its steel framework during construction



Fifty-three tons of water every minute tumble down the man-made cascade towering 120 feet high in the courtyard of the Westinghouse building at the New York world's fair. Taller than many a famous natural waterfall, only fifty feet lower than Niagara, the Westinghouse cascade consists of fifteen separate drops of eight feet each. The tower is an inverted cone of steel faced with a nearly perpendicular incline down which the water courses, controlled so that mist is sucked back into the tower and spectators are protected. Four centrifugal pumps feed the falls, the water recirculating and losing only five per cent by evaporation. Temperature in the surrounding court is cooled about eight degrees by the cascade. At night the water shimmers in light from mercury lamps.

Venetian Blind in Rear Window of Car Shuts Out Glare



Trim in appearance, Venetian blind in rear window shuts out glare from sun and from headlights behind

Venetian blinds are available as an accessory to protect motorists from glare through the rear window. The blinds reduce headlight glare from cars behind, and shut off direct rays of the sun.

More than 7,500,000 hunting, fishing and trapping licenses were issued to sportsmen in the United States during 1938, the latest year tabulated; Michigan led with 682,605, with Pennsylvania, New York, Ohio and Indiana following.

POPULAR MECHANICS

Portion - General Motors Corp. Detroit
K466
K492

Dept. of Interior
Information Service



OUR FLYING NAVY

Eyes of the fleet are these war birds at rest on the flight deck
of their "mother" ship, the U. S. S. "Ranger"





Overhead a brood of scouts and fighting planes swarm in formation (top) while the battleships beneath them execute a turn in war maneuvers. At left is one of the Navy's big amphibians in flight, with wheels in landing position and wing-tip pontoons, too, extended



PART II

By J. B. HANCOCK

FROM your bombing plane 3,000 feet up, the 888-foot landing deck of the "Saratoga" looks like a match stick tossing on the waves.

For three weeks you've practiced landing on a circle at the San Diego Naval Air Station, but this is different. The new brood of bombers assigned to the

"Sara" has found the big aircraft carrier 150 miles at sea, and the sky is full of planes wheeling around, awaiting the turn to hit the deck. The landing circle seems no bigger than a dime, always moving, rolling, pitching. The planes ahead have landed like clockwork, without a single wave-off. It's your turn next. Snap open the parachute harness, lower the arresting hook, flaps in position. Down you come, lower and lower, leveling off as you come over the stern. The signal officer waves you on. Right in the groove; a slight jar as wheels touch

Contributor - Mrs. Joy Bright Hancock, Washington Navy Dept. Bureau of Aeronautics

K96

deck, a stiff jerk as hook engages arresting gear. Then hands grasp the wings and rush you up deck to clear the way for the planes behind. No one knows of those beads of sweat that have broken out all over your body—no one except every pilot aboard who has some time or other made his first deck landing.

It was just seven weeks ago that you won your Navy Wings, and here you are at sea at last. Probably by now Dick, your chum at the Pensacola air school, is riding a scout plane off the catapult of



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Top, an SOC-1 seaplane ready for the jolt of its catapult on the U.S.S. "Minneapolis." Center, a plane sweeps upward from the deck of the aircraft carrier "Lexington." Bottom, two big carriers are neighbors at sea—the "Saratoga" seen from the deck of the "Ranger"





Twin-motored patrol planes, above, are on one of their long oversea voyages from San Diego to their Panama Canal base at Coco Solo. At left, changing propellers of one of the patrol planes

disposition of planes. Word comes from the cruiser scouting planes that the "enemy" has not been located in certain areas.

Over the loud speaker comes the command: "Man your planes!" Out on the flight deck the pilots weave among parked planes, ghostly forms in the eerie light of blue flames from seventy-five engine exhausts. The roar of thousands of horsepower and the whirling propellers is terrific. Already the scout planes are tearing down the deck, one by one, darting off into an inky black sky; bombers and torpedo planes follow in quick succession, then tiny single-seat fighters scream across the bow and climb away. The carrier, with her guardian destroyers close aft,

the cruiser "Philadelphia" while Harry is piloting a flying boat with Patrol Squadron 23 at Hawaii.

First major problem of your cruise comes after only a week on the "Saratoga." At 2:30 a.m. the signal to flight quarters brings aviators on the double-quick to the "Ready-Room" for a steaming cup of coffee and last-minute instructions—their object, probable distance,

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1/26

cuts through black water and all you can see is her phosphorescent wake and the twinkling wing lights marking the rendezvous of each plane group above.

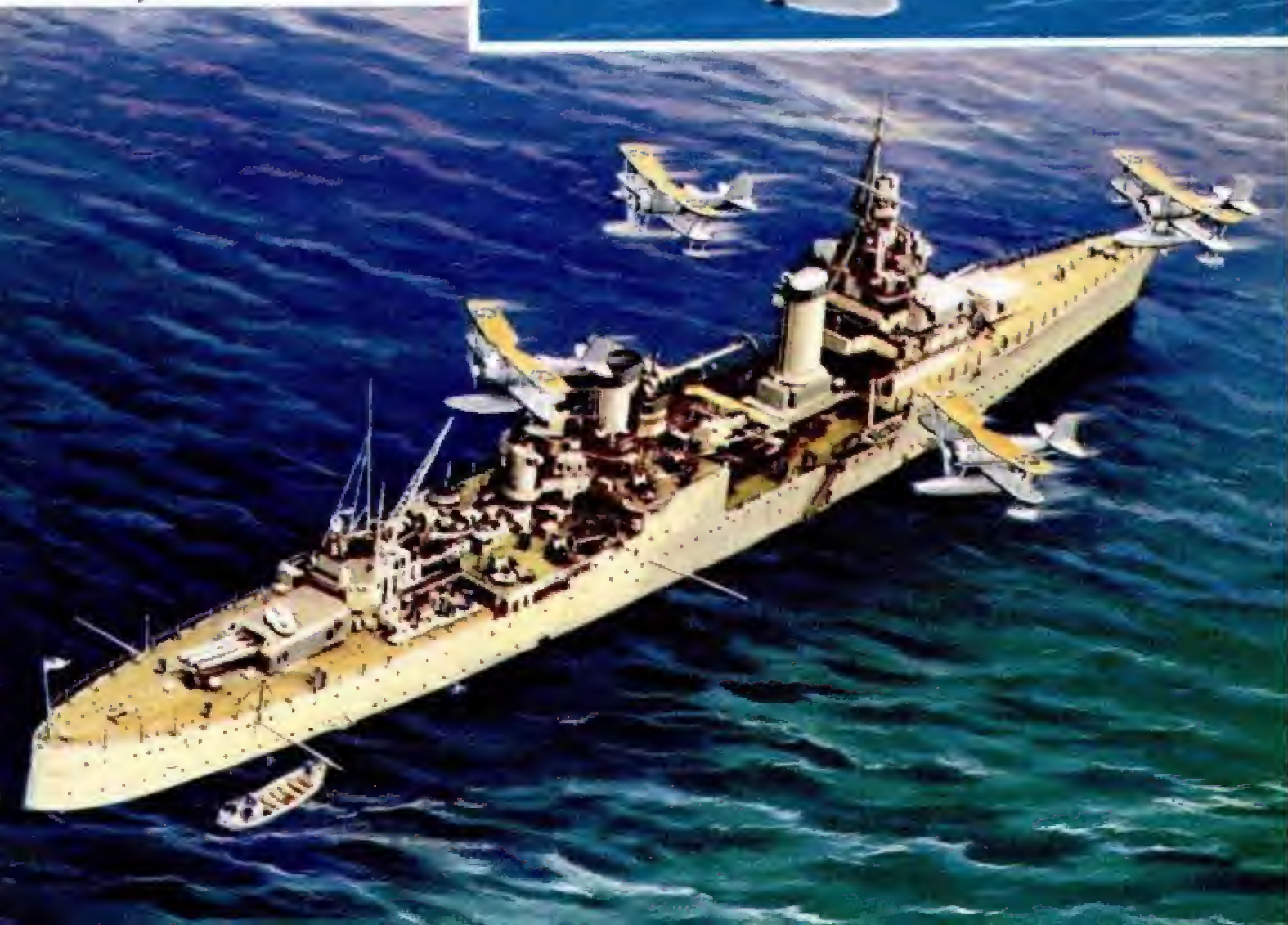
The scouts have teamed up and are away toward the objective. The fighters close up on them for a time, then split to either side to guard the torpedo and bombing planes from surprise attack by the "enemy."

You fly for perhaps an hour or two. Pink dawn is just beginning to light the horizon. You venture a peek around the windshield, and the wind jerks your head back like the shot of a catapult launching.

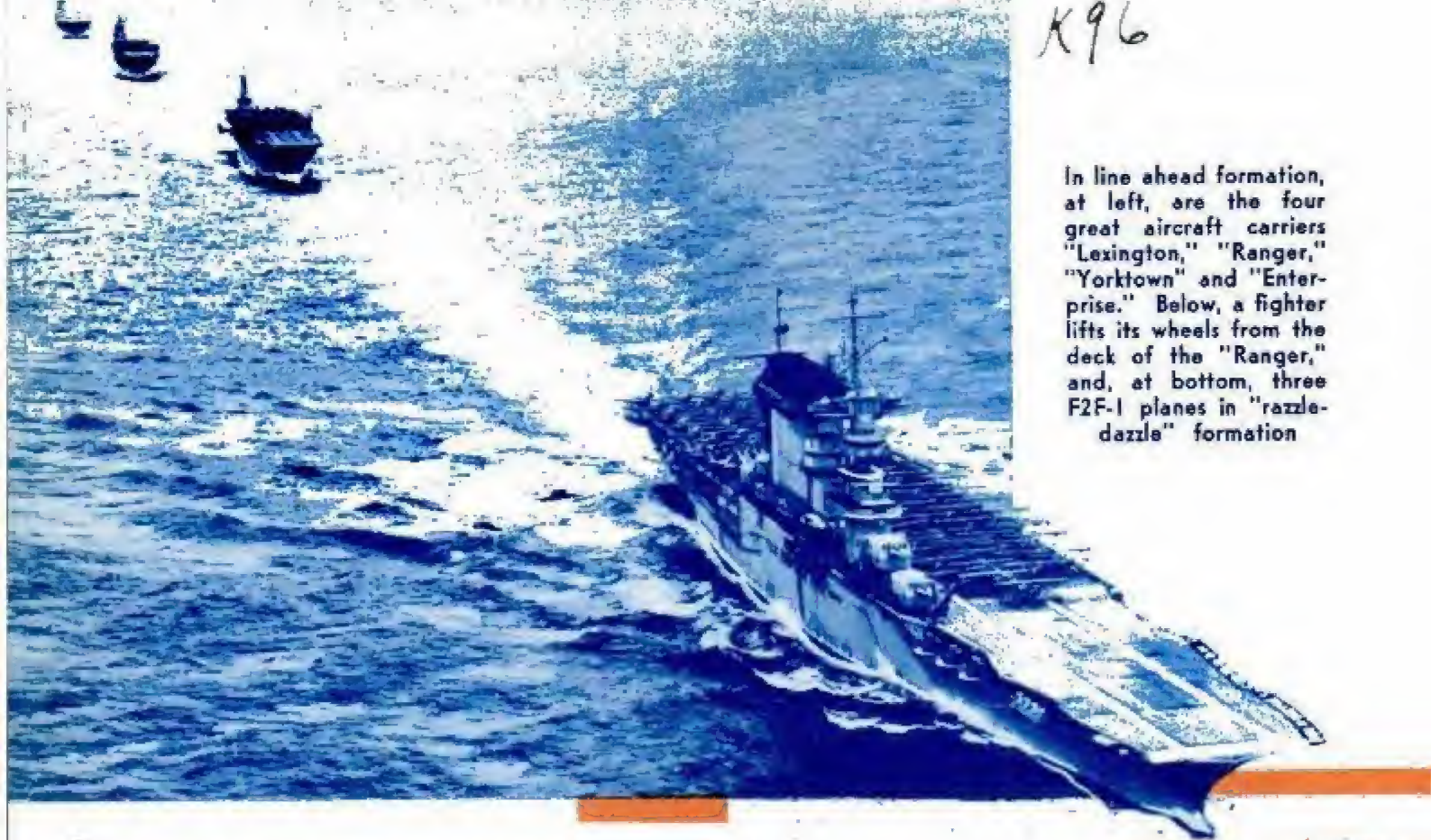
Suddenly you spot the tiny silhouettes of the enemy bat-

Right, a trio of F3F-2 planes flying in line. Below, four seaplanes in formation above the U.S.S. "Portland." Notice the plane on catapult amidships

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In line ahead formation, at left, are the four great aircraft carriers "Lexington," "Ranger," "Yorktown" and "Enterprise." Below, a fighter lifts its wheels from the deck of the "Ranger," and, at bottom, three F2F-1 planes in "razzle-dazzle" formation

22

tle fleet. Your scouts are battering through the aerial attacking line, offering seemingly perfect targets as they bore in for the information they need and radio it back to the fleet commander. The valiant little fighters are everywhere, diving, chasing, clearing the way. You've been climbing to position ever since the enemy was sighted; at 20,000 feet your squadron commander gives the attack signal. You adjust your stabilizer, rudder control tabs and diving flaps, and push over the nose until vertical is reached. The safety belt bites into your body. You sense terrific pressure on the wings. Down you go, every part of your plane screaming in sheer delirium. Eyes strain to watch the planes in front, for they must not be in the line of your bombs, and you hope the fellows behind are doing as much for you. The ships below spring up to meet you. The split second has arrived: you release your bombs, haul back on the stick, zoom a half mile upward on the momentum of the dive. Your own job is completed and you roar away for the close-up. The plane, lightened by the expended bomb load, answers quickly and you pull up to the tail of your section leader. The close calls of tight formation flying, the near blackouts on the dive, that bad mo-





23

ment in the slip stream of another plane, all fade away. Yes, the jigsaw puzzle works out all right, as they told you it would—provided each fellow remembers his own place in the picture. Over your shoulder you see your radio-man still glued to his set, listening for any break in the radio silence, his gunnery job finished.

The problem is over. A couple of hours later the carrier looms up dead ahead. Funny thing, this navigation; the "Saratoga" is not where you left her, of course; there are no signs to point the way, yet here is her brood of planes breaking into threes and fives, one tailing the other in an ellipse, waiting to go aboard. Again you are an automaton, responding to signals until

R96

Not many weeks after the aviation cadet wins his Wings of the Navy at Pensacola's air school he may be patrolling ocean skies in twin-motored planes like those above. Below, looking aft on flight deck of the "Ranger" as its fleet is prepared for takeoff





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Under the big guns, the steel control turret and the elongated funnel of the U.S.S. "Lexington" lies its brood of scouts and fighters, seemingly jamming the deck in hopeless snarl of wings and propellers but actually ready to roll on an instant's notice

K96
you receive the "cut," then again assuming complete charge of the plane. You're down, the crew immediately starts checking over the plane, you stretch weary muscles and start for that belated breakfast.

Day in and day out, in all brands of weather, the training goes on. Problems bring you in touch with new ideas; you even offer some yourself. Theoretical discussions are followed by practical tryouts. Finally during one night watch you move in on Hawaii. But you're on maneuvers, and a mock battle is fought before you are allowed to anchor. Patrol planes protecting the "Paradise of the Pacific" do a lot of theoretical damage to some of your ships before that time.

Then shore leave, and a rendezvous with Dick and Harry. Their versions of the big problem supply the missing pieces of the picture.

"You can't imagine the thrill of advanced scouting
(Continued on page 128A)

Russian Army Mystery Gun Does Not Recoil

Arms experts were baffled when they examined Russian guns captured by Finnish soldiers. The guns do not recoil when fired, but the mechanism that prevents recoil has not been explained. The breech has a funnel-like attachment which swings to one side. One theory is that this funnel utilizes explosion gases escaping through vents to produce a forward movement neutralizing recoil.



At left, front of Russian gun; above, rear view showing funnel-like device which may absorb recoil



Observatory Two Miles High to Watch Sun's Corona

Two miles high in the Rockies, Harvard University is establishing the world's highest astronomical observatory. Located at Fremont Pass, Climax, Colo., at an altitude of 11,318 feet, where the air is as nearly as possible dust free, it is to be a scientific outpost for observation of the sun's corona, or "halo." It will be equipped with a telescope which masks out the image of the sun but leaves the corona visible. By standing watch over the corona, scientists hope to forecast the violent electrical storms accompanying sun spots.

Gas-Powered Lawn Sweeper Collects Leaves in Basket

Leaves and refuse on the lawn are picked up so gently by a gasoline-powered sweeper that the operation cannot injure the growing grass. Its whirling movement also lifts low-growing crab grass and spreading weeds so the lawn-mower can cut off the seed pods.

(American railroads set a new record in average speed of freight trains during 1939, the average distance traveled by a freight train per day rising to 401 miles from 398 in 1938, 386 miles in 1937 and only 247 miles in 1920.



Leaves swept from lawn are rolled into bundle as at left

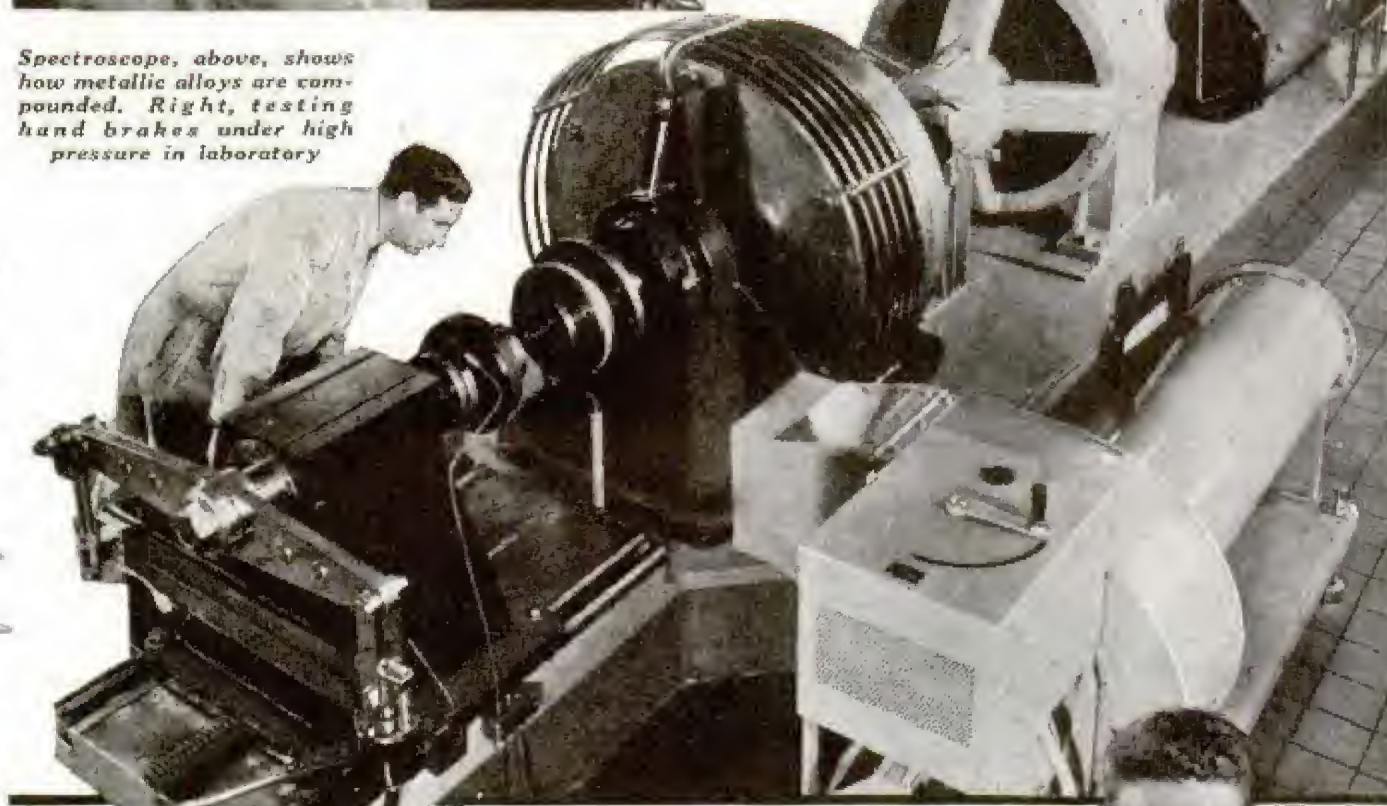
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Leggett

TORTURE-TESTING *the*

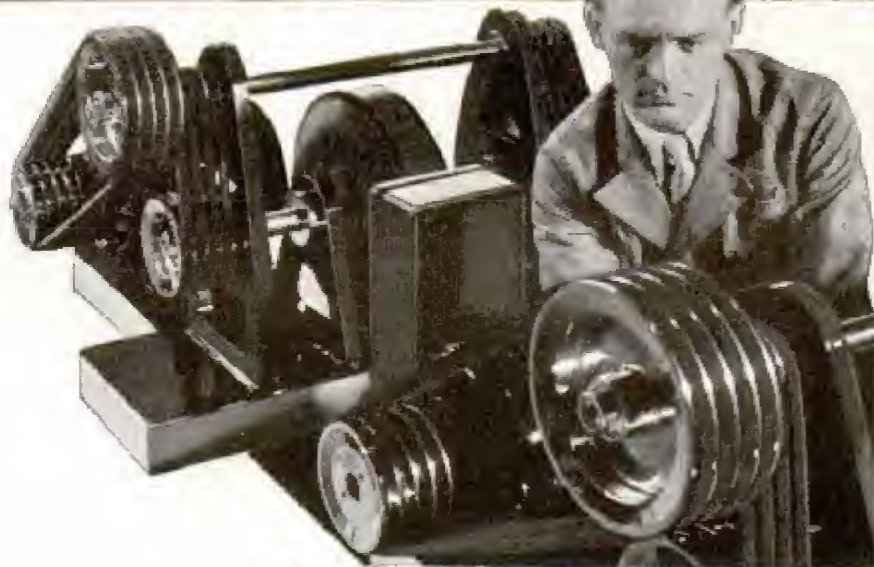


Spectroscope, above, shows how metallic alloys are compounded. Right, testing hand brakes under high pressure in laboratory



Retract. mech.

Chrysler Corporation has just completed two new research laboratories equipped with some of the finest engineering machines and instruments in the world. Here every part of the automobile will be subjected to torture—twisted, pulled, pushed, strained and pounded. Above, a massive dynamometer for testing hydraulic brakes can create conditions equivalent to a car traveling 100 miles per hour. Right, testing Fluid Drive coupling (circular housing mounted on lower shaft of machine behind the laboratory worker)

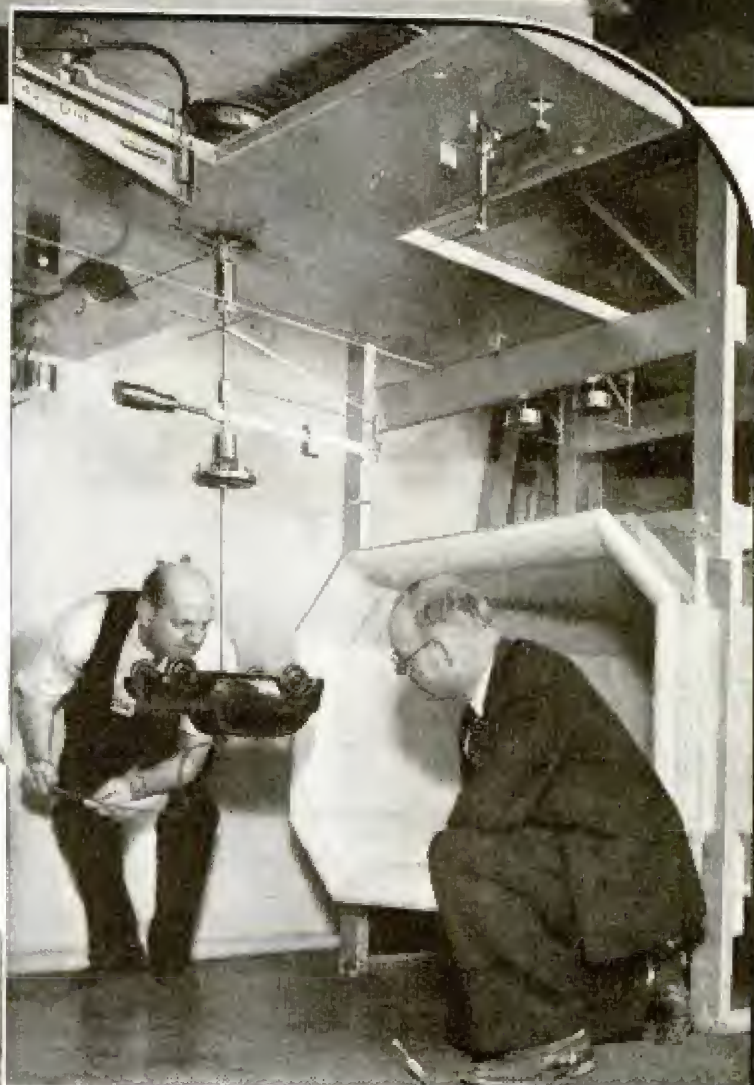


*James W. Lee, Jr.
Public Relations Dept.*

CARS *of* TOMORROW



Top, transparent section of Plymouth connecting rod, made of plastic, is tested under load with aid of polarizing screens, shown on each side of large condensing lenses. Below, shadow lines reveal internal stresses in connecting rod

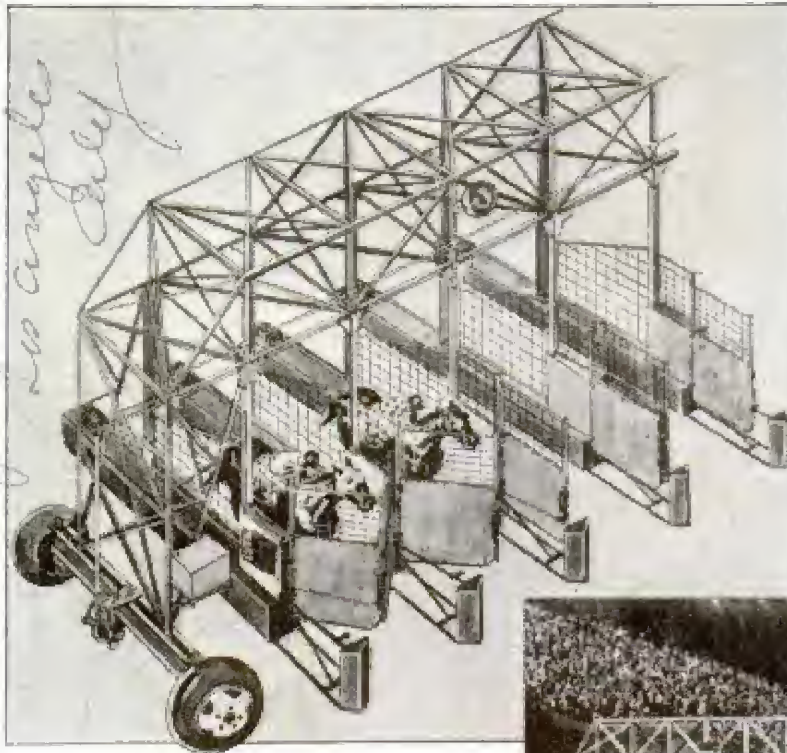


Above, working with exact-scale model of auto in wind tunnel at the laboratories. Left, X-ray tube, such as is used in probing secrets of mysterious bonds that hold metals together. These are only a few of the machines and instruments employed in the new laboratories to study every factor affecting comfort, utility, safety and service of automobiles and trucks. No engineer is satisfied with today's car, rather, he is constantly looking to tomorrow's model

Electric Gate Gives Race Horses Even Start

Equipped with features specializing on safety and quick breaks, an electric gate used at some American tracks assures an even start for race horses. Swing-out doors of V-pattern, attached to the front

of each stall, are opened by releasing electric solenoid locks. There are fourteen stalls in each gate. The forward doors are closed by hand, and may be opened by hand in an emergency. The horses are walked into the stalls up to the doors and tailboards are dropped behind, inclosing each horse in a stall and in position for the start. When all are ready, the starter presses a button, electromagnetic units release the locks and the gates swing out with lightning-like speed, permitting the horses to race away together. The ability of the horse and the rider's alertness at the post are said to be the sole factors in securing leading positions at the start of a race.



Above, sketch of Puett electric starting gate, designed to get horses away to an even start in a race. Right, a typical start, with the horses breaking from the stalls at virtually the same instant



Two-Faced Watch and Timer Has Second Hand in Back



Two views showing face and reverse side of timer

Handy both as an ordinary pocket time-piece and for timing sports events, a combination watch has a conventional front face and a second hand at the back. The second hand is stationary, while its dial rotates. It can be stopped and started instantly by a slide control at the side.

No Holidays for Diesel Engine

Without any time off for repairs, the Baltimore & Ohio Diesel-electric locomotive-No. 56 is in its second year of steady work after having finished 365 consecutive daily runs of 772 miles at an average speed of fifty-six miles an hour.

Capitol Limited.
POPULAR MECHANICS



IN CASE of FIRE-

Engineer.
By Chief Peter Kiernan

Newark Fire Department

Sept. 10 Public Safety
ALL big fires were once little ones—a spark, a glowing cigarette, a flaming match head, Mrs. O'Leary's lantern. The difference between a small fire and a conflagration is usually a matter of minutes. If we must have fires, let's keep them small.

Everyone can cooperate in this, if only to call the fire department promptly. Do you know where your nearest fire-alarm box is? When one has turned in an alarm, he should wait at the box until the fire company arrives, to direct them. Otherwise precious minutes may be lost looking for the fire.

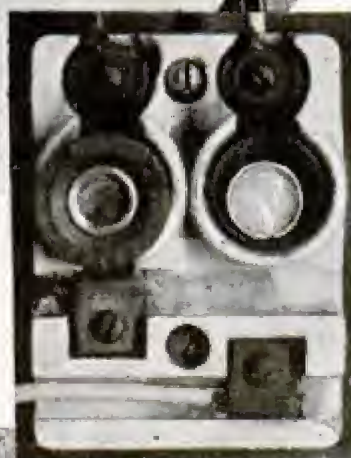
If there is a phone in the house, and the fire is not threatening the user, it is quicker to phone the alarm than run to the box. Call the operator, say; "There's a fire at 707 Blank street," repeat the street and number, then make sure the operator repeats it correctly. You'd be surprised how many persons report fires, without both-



One way to keep children from growing old is to let them play with matches (top). Defective electric wiring and hunting in dark closets with a match are frequent causes of fires, center. Below, when the roast bursts into flames, slam the oven door



To replace a burned fuse with a penny, above and at right, is to remove deliberately an essential safety device. Below, if a door feels hot, don't open it; at right, celluloid or Pyroxylin toys and novelties burn violently, and are easily ignited when exposed to heat



the window. If a curtain catches fire he can rip it down, stamp it out, before serious damage is done. If he's been smart enough to buy a small extinguisher, and remembers where it is, he can put out a small blaze in a jiffy.

If it's an electrical fire, pull the plug or turn the switch—shut off the source before fighting the results. Quick now! Do you know where the main switch is in your home? Could you find it in a hurry, especially in the dark? If not, find it now; impress that location on your memory.

If a person's clothing catches fire, throw him on the floor so he will not inhale the flames, and roll him in a coat, blanket, or rug. The worst thing such a person can do is run. This fans the flames, causes deeper breathing. A whiff of flame will kill.



ering, in their excitement, to give any address. The fire engines get there a lot quicker if it is known where they are supposed to go.

A man who does not get rattled can frequently squelch a blaze before it gets under way. If he drops a match in the waste basket he can carry the basket to the faucet, turn on the water. Or pitch it out

Never fry anything in deep fat without having a lid to the pan ready. If the fat flames up, clap the lid on and the fire dies right there. If something in the oven catches fire, slam the door and let it burn itself out. It's easier to clean up a mess in the oven than to clean up the kitchen after firemen have poured in a ton of water. If burning grease spatters over the kitchen,



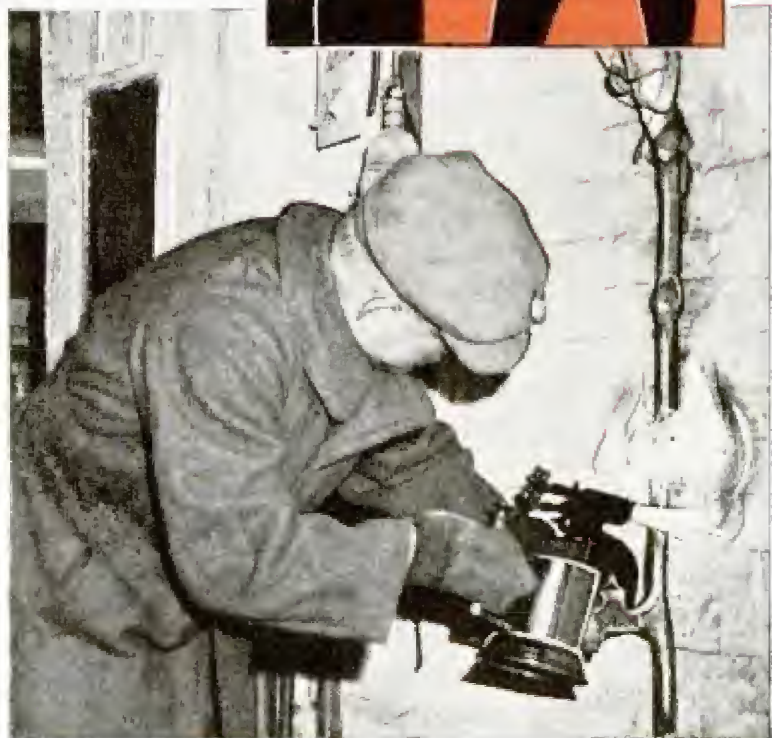
don't use water; that will spread the fire. Throw on handfuls of salt or flour.

A woman should confine her fire fighting to the simplest of rules—slamming shut a door, clapping on a lid, pulling a switch. Never, under any circumstances, should she attempt to play fireman. Never should she stamp on flames or pick up anything that is burning. Her clothes, her long hair, are too inflammable. If she discovers a fire she should close the door, confine the blaze, then call the fire department. That done, she should go outside, and remain outside until the fire is extinguished. The only exception I make is in case a child is in danger. She can then take risks not otherwise justified.

If you wake up in the night and smell smoke, investigate swiftly but cautiously. Never open a door without feeling it. If it is cool, brace your foot against it so that it cannot be blown inward, then open it a crack. If the air outside is cool, the door may be opened. But if the door is hot to touch, keep it closed. If hot air rushes in when you open it, slam it shut. It is too late to make your escape, or to perform any rescues, that way. The superheated air will keel you over.

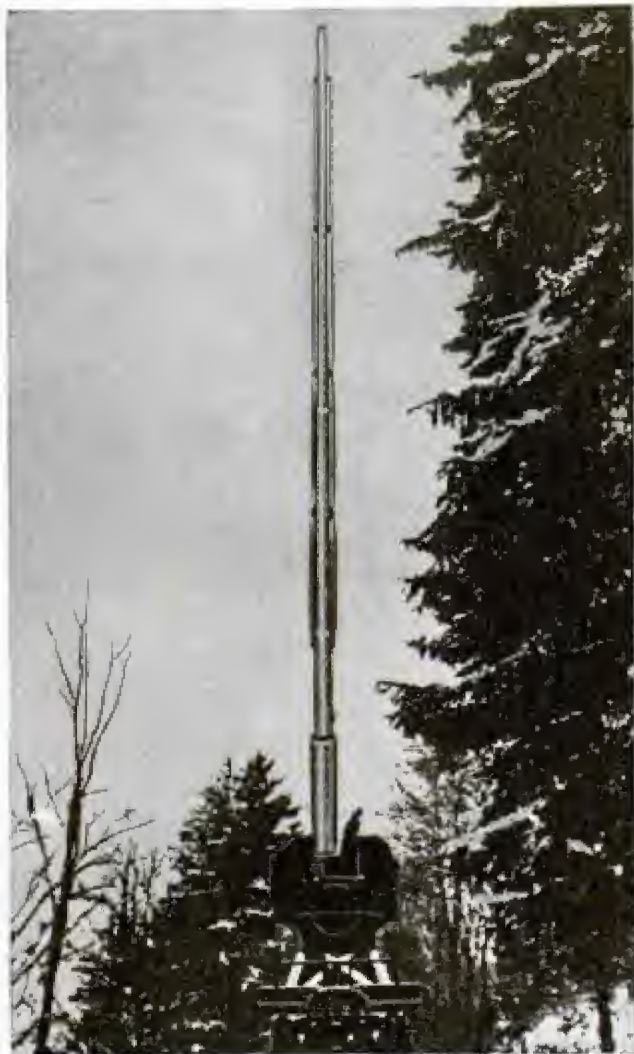
Trapped in the room, the only thing you can do is smash the window, top and bottom, and shout to arouse the neighbors or passersby. Then, unless near enough to the

(Continued to page 135A)



Too many fires start from carelessness—irons forgotten, ashes dumped into cardboard boxes. Gasoline is more explosive than dynamite; to use it for cleaning is to court death. Don't thaw frozen pipes with a torch, use cloths soaked in hot water

Seventy-Two-Foot Big Gun Aims at the Stratosphere



With a high trajectory, this German weapon is ready to hurl a long-distance shell through stratosphere

Hiding in the woods somewhere back of Germany's west wall fortifications is the modern "Big Bertha," counterpart of the long-distance cannon that hurled shells into Paris during the first World War. Still untried as an engine of destruction, its barrel is seventy-two feet long. The gun points at a steep angle, flinging its projectile high into the stratosphere where air resistance is less and the shell can carry farther toward enemy country.

Gravity Meter Hunts for Oil by Weighing Earth's Pull

Oil prospectors are trying their luck with a supersensitive gravity meter developed by two University of Texas physicists. A small weight dangles from the coil spring in the meter. When it is held over a salt dome, the weight is deflected upward because the dome is less dense than sur-

rounding formations and so has less gravitational pull. Presence of the dome is an indication, although not a positive one, that oil will be found below. The meter's spring can weigh as little as one hundred-millionth of a pound. Ordinary scales cannot detect a difference in weight of a body at sea level and at 20,000 feet above; this new gravity meter can detect a change in weight of the same body when it is raised just two inches. In using the gravity meter to search for oil, readings are taken every half mile over a fifty-mile area and the slightest change in gravitational pull noted, making allowance for changes in altitude and direction.

Lightweight Camp Stove and Oven Costs Little to Operate

Serving a wide range of cooking uses, including baking, frying and boiling, a compact stove that fits a space ten by twenty inches, is also a handy heater in the camp or on board a boat. The oven, which is insulated, heats up to 450 degrees in fifteen minutes, and the entire top becomes hot enough to boil water. Burning kerosene, the stove will operate four hours on ten cents worth of fuel. No chimney connection is required.



Camp stove, easy to carry, bakes, fries or broils, and gives enough heat to warm small room or cabin

see June 1939. 1141

Mr. Arnold Romberg,
Lucien La Costa.

Concordia Boaling Store.
612 Bridge St.
South Dartmouth
Mass

K 401

Made by Auto-Brake Company
9 America drive
Baltimore, Md (Auto-Brake Company)

Trailer Phone Booths Serve Remote Corners

Mobile telephone service is now available where only temporary installations would be required, as in the case of circuses, carnivals and outdoor sporting events. The trailer can be put into immediate operation by connecting a line with the nearest phone cable.



April Is Safest Month on Calendar of Accidents

You're safer in April than in any other month. Statisticians say the average number of fatal accidents per day reaches a low point of 251 in April, compared with 285 deaths per day the rest of the year. It is an in-between month: accidental falls on the ice, smothering and gas asphyxiation are tapering off and the accidents of the swimming, boating and lightning season have not yet begun.



Inside the mobile telephone station are a switchboard and private booths

One-Cylinder Midget Auto Run by Gas, Battery or Foot



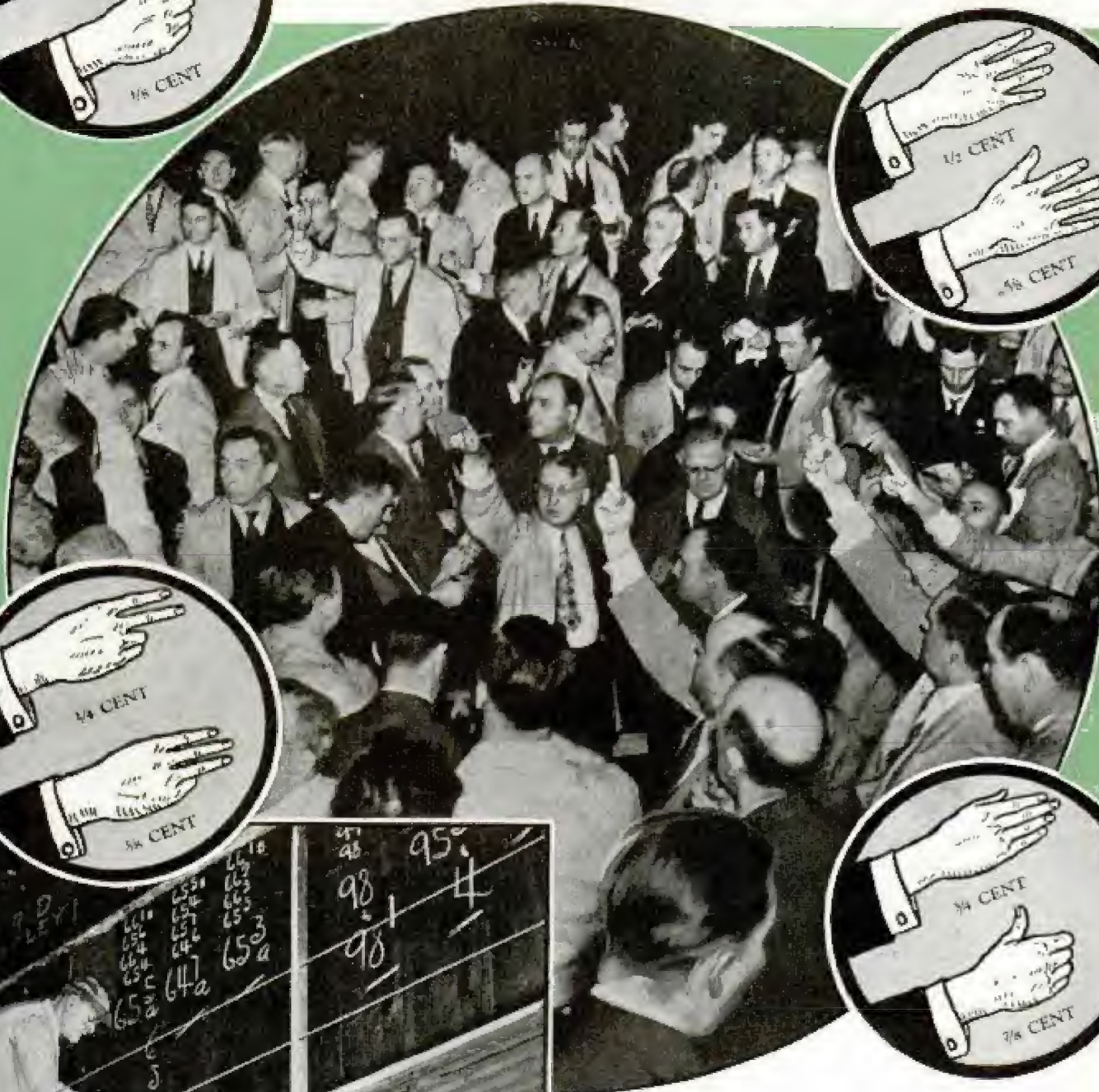
Two men can easily carry this car, which runs 165 miles on a gallon of gas

Running out of gas does not worry the owner of a miniature Italian car, since it has a storage battery capable of running it seven hours in an emergency. After that, it has pedals to drive it the rest of the way home or to a filling station. The tiny auto, which will sell for \$250, is so light that two men can pick it up and carry it into the garage or house. Its one-cylinder engine drives it at top speed of fifty miles an hour and it runs 165 miles on a gallon of gasoline.

Law. Marcello Creti
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BEHIND *the* SCENES



A busy moment in the wheat pit, above; signals are explained in drawings. Traders with palms held outward offer a sale; palms in, a purchase. At left, ticking of Morse key is translated into latest quotations on blackboard

By Roderick M. Grant

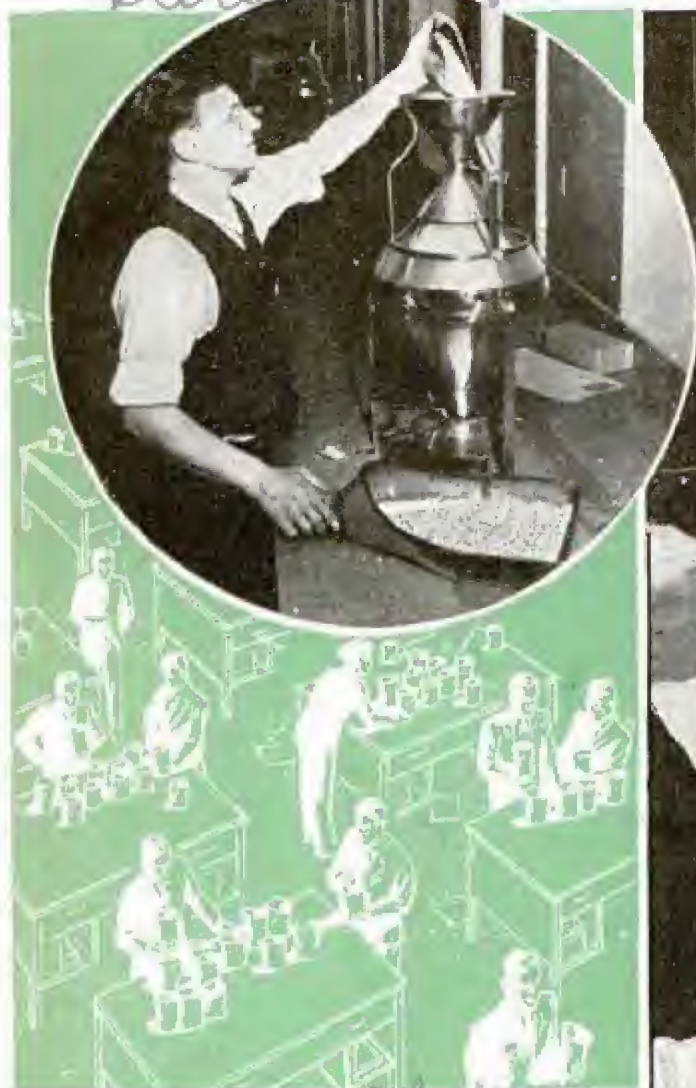
WHAT you see on a visit to the galleries of the Chicago Board of Trade are the flying fingers of traders signaling in a sign language as lucid to you as Sioux or Choctaw the purchase and sale of carloads of wheat and corn yet unplanted.

What you don't see are fields of waving

gold from Kansas to Minnesota, trainloads of grain and soybeans snaking toward Chicago, inspectors thrusting long sampling rods into cars of corn and rye, funneling samples of grain through electric moisture meters, "pearling" the husks from barley to detect heat-damaged kernels.

in the GRAIN PIT

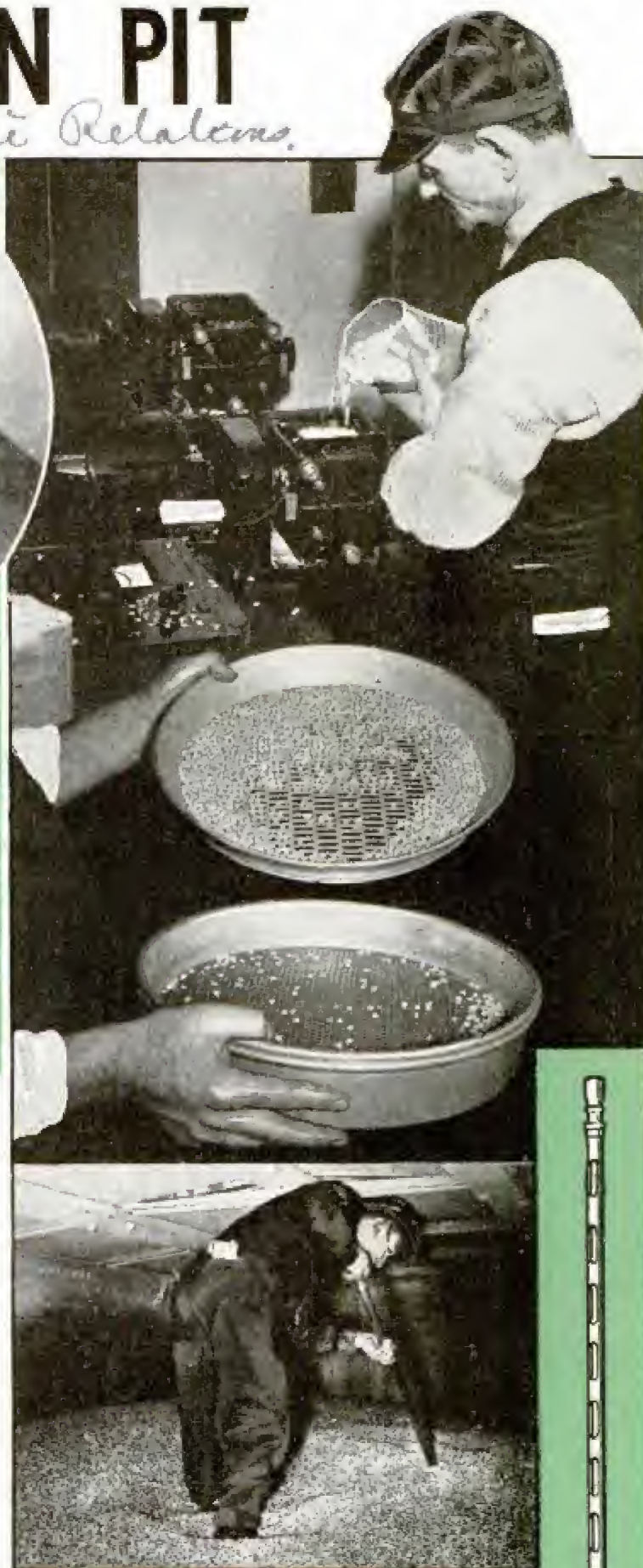
Director of Public Relations.



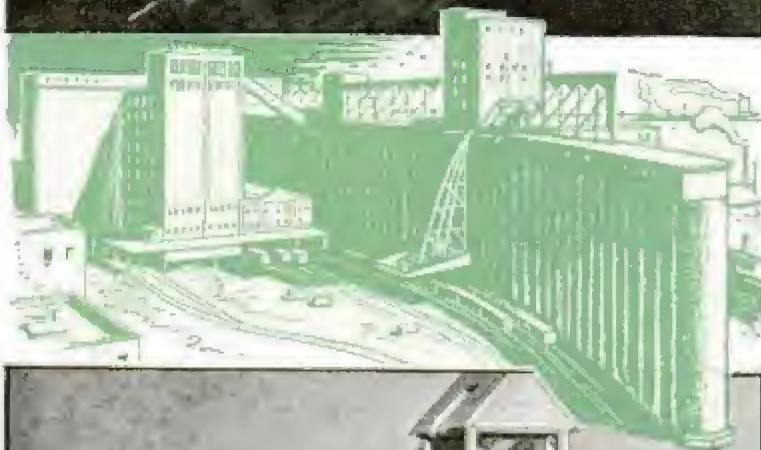
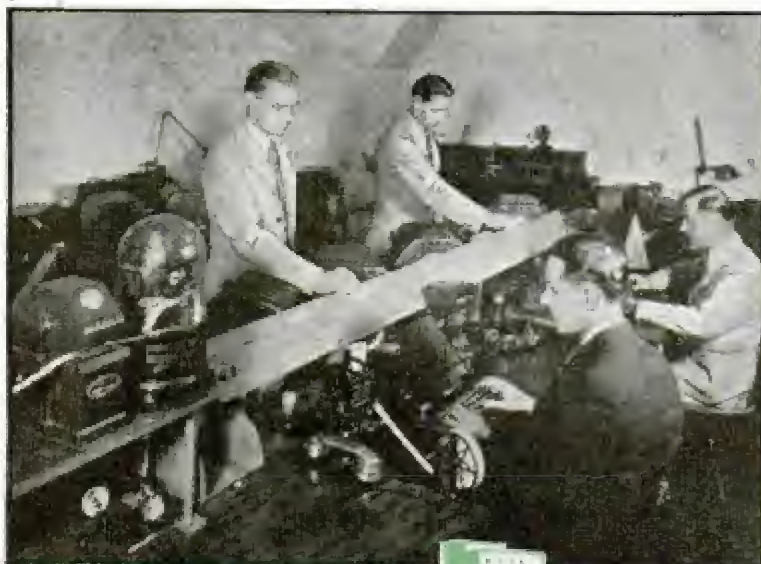
Those are details of a great panorama at the center of which stands the Board of Trade, mid-point between the farm and your dining-room table. Before that waffle or breakfast food or whole-wheat toast reached your plate it may have changed hands a dozen times on the Board in the form of contracts to purchase grain in some specified future month, or in the form of warehouse receipts for cereal in an elevator awaiting a final purchaser.

For Chicago is the world's largest grain-distributing center and its Board of Trade, greatest of commodity markets, is an open trading post for farmer, merchant, miller, exporter, investor and speculator in grain and provisions.

Nine months before September



In circle, "splitting" bag of corn in Board of Trade sampling room to obtain accurate cross-section for testing. Right, pouring corn into electric moisture meter. Center, sifting soybeans for undersized and split beans. Bottom, sampling rod (drawing, right) probes carload of corn. Drawing, left, shows cash grain trading



harvest, trading begins in contracts for delivery of wheat in that month. A Dakota farmer may take advantage of high prices in May to sell his crop in advance. A miller may order grain in August for delivery in December if he anticipates higher prices before he will need manufacturing supplies. A country elevator, having just paid a farmer \$5,000 for 5,000 bushels of wheat and having no desire to risk either profit or loss, will hedge its purchase by an immediate

"short" sale of 5,000 bushels in the futures market; then, when the elevator actually delivers its wheat to a cash purchaser, it will buy back its futures contract at the same time, having protected itself from changing prices in the interval. And you, who have no use for a binful of wheat, may guess in July that war is coming before Christmas and buy a thousand bushels for December delivery on a small marginal payment to your broker, and when war lifts prices you may sell at a profit. Or sudden peace and plentiful world crops may knock the props from under your speculative investment and leave you with a loss.

What happens when you, a Des Moines storekeeper, decide now is a good time to buy wheat? On June 14 you call your broker, Quincy & Adams Bros., and order 5,000 bushels of wheat for September delivery "at the market"—whatever the current price may be; you could, if you wished, specify the price you'll pay and leave the order to be executed whenever wheat touches that price.

Over a private wire from the Des Moines branch to the Chicago office of Quincy & Adams flashes a message: "Buy 5 Sep wheat mkt a/c John Smith Des Moines." The Chicago operator jots this on a purchase order blank, numbers the order and slips it under a time clock to be stamped: "1940 Jun 14 AM 10 46 3." Which means the



From top: telegraph quotation room; modern grain elevator; model of old country elevator; sending a broker's order to pit

order came in at thirty seconds after 10:46 a.m. A telephone operator for Quincy & Adams flicks a switch and a red bulb lights at the Quincy & Adams telephone post in the Board of Trade. There an operator copies the purchase order, dispatches it by messenger to the firm's trader in the wheat pit, an octagonal "crater" of steps on which the Board of Trade members face each other to conduct their trading. Or the operator may communicate the order to the pit by the firm's code of hand signals.

Immediately the Quincy & Adams man in the pit raises his hand, palm inward to indicate he wants to buy, one finger extended vertically to indicate the quantity, 5,000 bushels—for that is the unit of trading; 1,000 to 4,000-bushel orders are "job lots." The price your trader bids is indicated by finger signals in eighths of a cent. If wheat is selling around ninety-seven



Above, hoisting grain from ship to model elevator. Left, wheat pit of Chicago Board of Trade, with bank of brokers' telephones in foreground. Below, pit clerk puts latest price change on telegraph ticker



cents a bushel, one finger extended horizontally means $97\frac{1}{8}$ cents; two fingers spread apart, $97\frac{1}{4}$; three fingers, $97\frac{3}{8}$; four fingers $97\frac{1}{2}$; four fingers and thumb, $97\frac{5}{8}$; four fingers and thumb extended but pressed together, $97\frac{3}{4}$; thumb extended alone, $97\frac{7}{8}$; the clenched fist, 97 cents even; or, if prices are closer to 98, the clenched fist would represent an even 98 cents.

Usually in a matter of seconds a seller raises his hand palm outward, signals agreement on price,

(Continued to page 138A)



K 39 3

Riddle of Huge Stone Heads Puzzles Scientists in Mexico



Five of these gigantic stone heads of mysterious origin, the largest weighing over twenty-five tons, were found in Mexico

Mystery surrounds five great stone heads unearthed in jungles of Mexico near the western edge of the state of Tabasco, by a joint expedition of the National Geographic Society and Smithsonian Institution. No clues were found to give a hint of their age, what type of Indian carved them, or what part they might have played in the religious life of their creators. How the colossal carvings were transported to their present sites also is a puzzle in itself, since the nearest source of basalt, the material from which they were carved, is 100 miles away. The heads range in height from six feet to eight feet and the largest is estimated to weigh more than twenty-five tons.

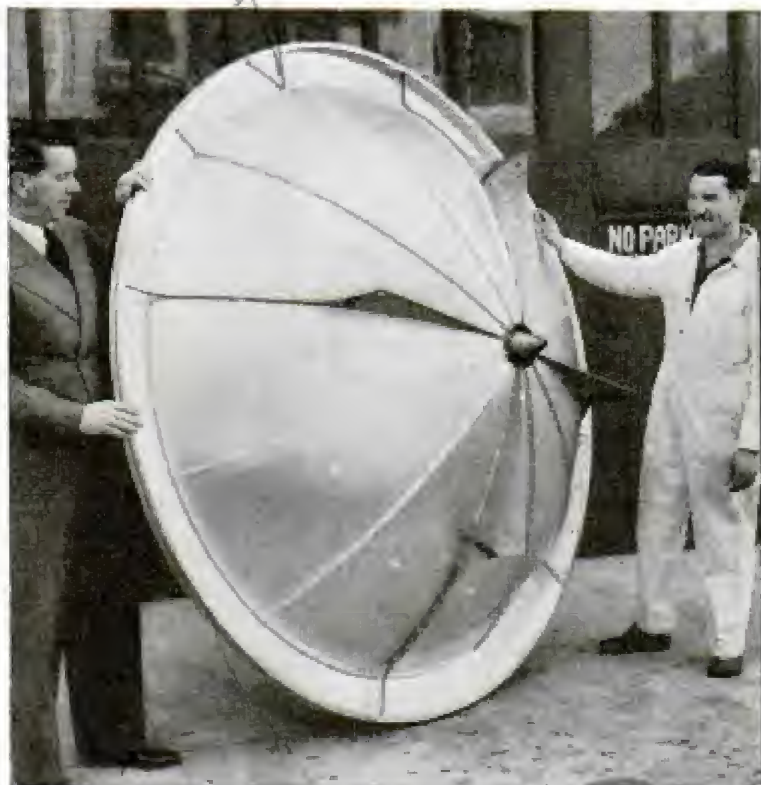
Wood Converted to Liquid Offers New Synthetics

Water-white liquids obtained from wood, the product of Canadian chemists, may provide raw material for new synthetic products, and also open a way to use wood that now goes to waste. Liquid woods are made under high

pressure by adding hydrogen to the molecules, similar to the method by which Germany converts coal into gasoline. In describing the new process, Prof. Harold Hibbert of McGill University explained that one of the new liquid woods is closely related to the substance from which the synthetic fiber nylon is made, and that it should prove possible to produce a new variety of this fiber with wood as the raw material.

Six-Foot Metal Reflector Built in Twelve Sections

Instead of being produced in one piece like their smaller counterparts, large-size aluminum reflectors are built in sections which must be bolted together to form a single unit. Twelve such triangular sections, crowned to a radius of three and one-half feet, complete a reflector with an inside diameter of six feet, and twenty-one inches deep. At the back, four steel fins jut outward to provide supports for installing it. In one large auditorium the light spread by five of these reflectors is ample to illuminate the entire floor.



Made of twelve triangular aluminum sections, this reflector is bolted into a unit with inside diameter of six feet

Washington, D.C.

Science Service
April 8

S + M Lamp Co.

Los Angeles, Calif.

Passengers Ride Upper Air in a Sealed Cabin



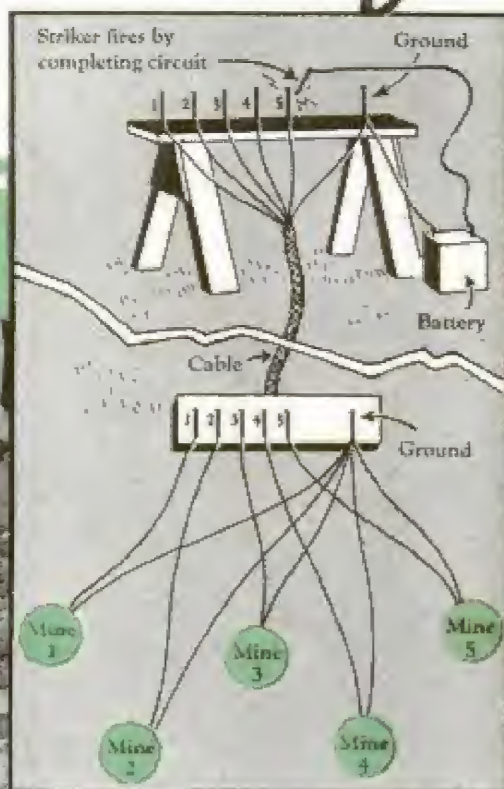
Above is a view of the Strato-Clipper's cabin, with its curved walls. The plane is circular in cross-section for strength in high-altitude flight. At top, right, are the flight engineer and navigator



Air travelers have their first opportunity for regular stratosphere flight in Pan American Airways' "Flying Cloud," four-motored Boeing plane with supercharged cabin. In the rare air above 20,000 feet, passengers will breathe air compressed to density of 8,000 feet. Diagram at left shows how the plane will fly above rough and thick weather. In circle are four of six-man crew, captain with hand on throttle, first officer at his right, radio officer in left foreground, engineer at right. Navigator and steward are not shown. Gross weight of the plane is 45,000 pounds; it carries thirty-three day passengers, twenty-five at night

K 52. Charles G. Cashman, p 27 21
 Avon St. Los Angeles

MASTERS of



Above, Lee Zavitz (second from left) at sawhorse firing board, plans mine-laying operations; circuit is shown in drawing. Mine at left exploded a split second after tank passed over it



THE last chunk of cork was tamped in the metal container loaded with a six-inch, five-per-cent dynamite bomb. A similar load was in another container almost under the driver's seat in the freight wagon. Somewhat apprehensively, the film director watched the firing wires hooked up to the six-volt battery, switch and bomb.

mite behind him as the horses raced away, unscathed, the driver standing between the rear pair.

The powder man had added a new thrill to a long list which men in his profession have contributed to the movies. Wagons had been blown up before but never so sensationally. Zavitz perfected the wagon

"Are you sure it's safe?" he asked Lee Zavitz.

"I'll ride the wagon myself, if you want me to," the powder man said eagerly.

He was denied this pleasure, however, and a stunt man raced the four-horse team across the hillside in front of the camera and threw the firing switch beside the seat. At the same instant he leaped forward to a tiny step on the wagon tongue. The wagon seemed to dissolve in a roar of dyna-

DESTRUCTION



for "Gone with the Wind" battle scenes after dynamiting a number of freight wagons in "Man of Conquest."

Actually, it was not blown up. Hooks invented by the powder man and released by squibs fired with the bombs, caused the horses to be released and the wagon to fall apart. The bombs threw cork and peat moss upward from containers riveted to the bottom of the wagon and appeared to have disintegrated the vehicle. Even the rear wheels were flung high in the air.

Zavitz is one of a handful of powder men in Hollywood who are experts on destruction. They can do anything with explosives from staging a modern battle to



Diagram and night scene on a Hollywood battlefield. The powder man firing the flares, star shells and mines can be seen at his switchboard at extreme right of photograph



exploding a golf ball in mid-air. Anything script writers or directors may ask, these miracle men are supposed to do in the most spectacular way with entire safety to cast and crew. Ships, wagons, trucks or battlements loaded with players melt away under terrific explosions; glass containers or windows are smashed by bullets or concussion, but there must be no flying glass; structures must be dynamited with hundreds of people around, but woe betide the powder man that hurts one!

Explosions must be real, or at least so deceptive that a critical audience can't tell the difference. The powder man must get reality with safety, for one bad accident might finish him in motion-picture work. Despite this, the list of killed and injured is increased each year.

Rarely are powder shots faked, for cost is comparatively small and the spectacle is everything. No adequate substitute has been found for explosives.

Zavitz, Walter Hoffman, Carl Hernandez, Harry Red-

man, Louis Witte and a few others have stored up an amazing fund of knowledge on explosives. They know firing, fracturing qualities of materials, directional firing of charges, mixture of powders, splintering qualities of woods, friction, pressure and combustion as it applies to their work.

Every one of them has devised gadgets ranging in size from Zavitz' wagon to tiny

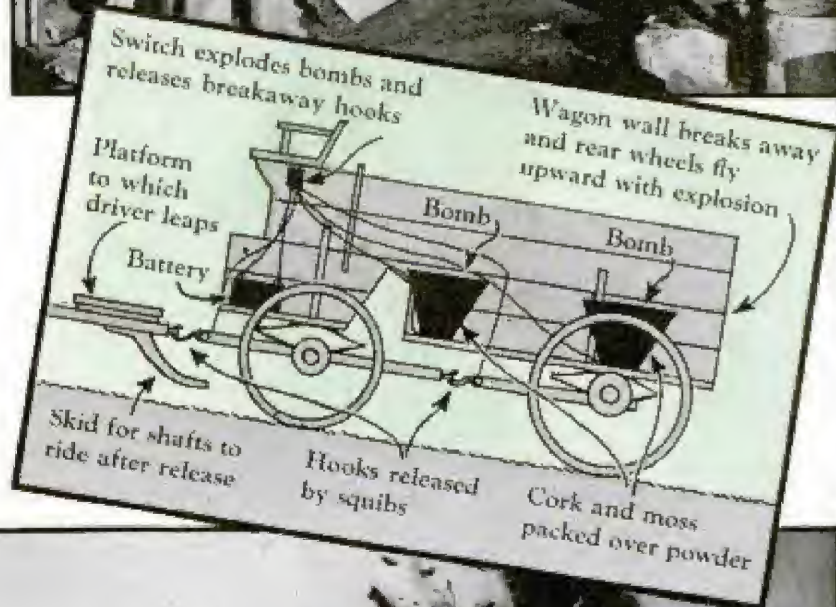
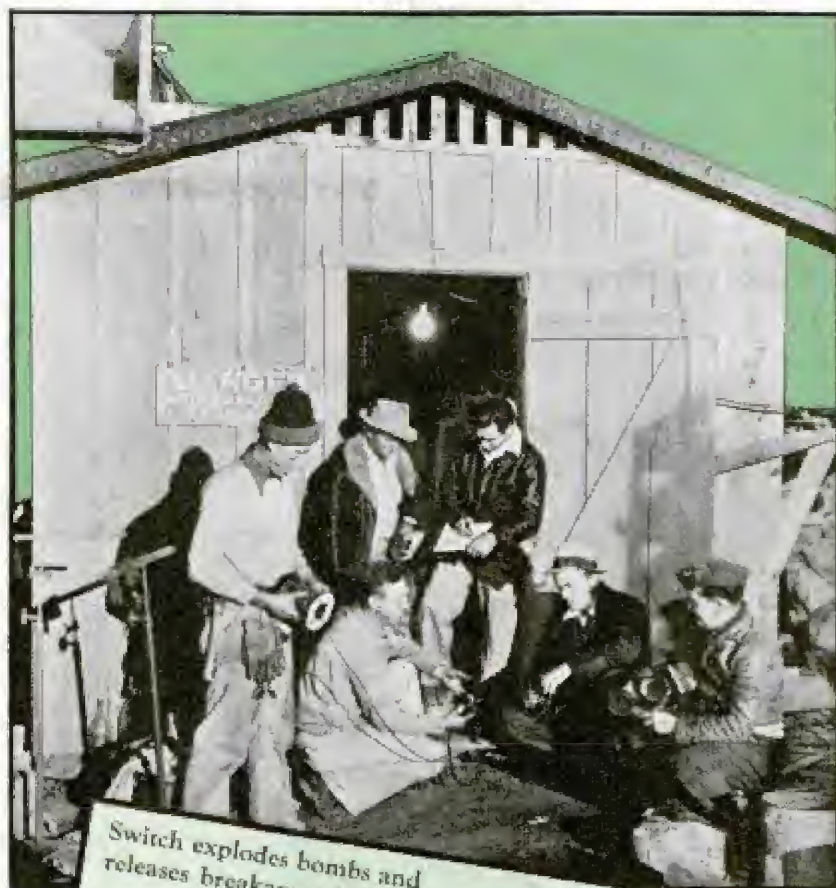


Directional explosion of twelve ounces of black powder, top, does not injure players in foreground, only six feet away. Below, dynamite bomb fired by remote control envelops small army tank in dirt

squibs. Virtually none of their inventions are patented. One of them said, "I would soon be out of a job if I patented things. The studios wouldn't hire me because they would do what they wanted in a little different way. Besides, I can't sue studios on which I am dependent for a living."

Insurance agents shun powder men. In many cases even the blanket policy the studios carry covering all who work on a production exempts them. Such was the case on "Gone with the Wind" where Zavitz was the powder man. He burned Atlanta for that picture, the largest controlled fire ever made. Forty acres of downtown Atlanta during Civil War time were constructed. Zavitz strung five truckloads of one to four-inch pipe through the buildings, studding them with atomizers. On a double intake leading to oil and water tanks he rigged a powerful pump. Four-inch valves allowed either oil or water to be pumped into the buildings.

(Continued to page 118A)



Top, checking out supplies from powder house for war scenes. Below, wagon is apparently blown to bits as driver, who fires bombs with switch beside seat (see diagram) leaps to tongue

Warner Bros.
Fighting 69th

Hooded Pilot Flies Big Plane 'Blind' from Start to Landing



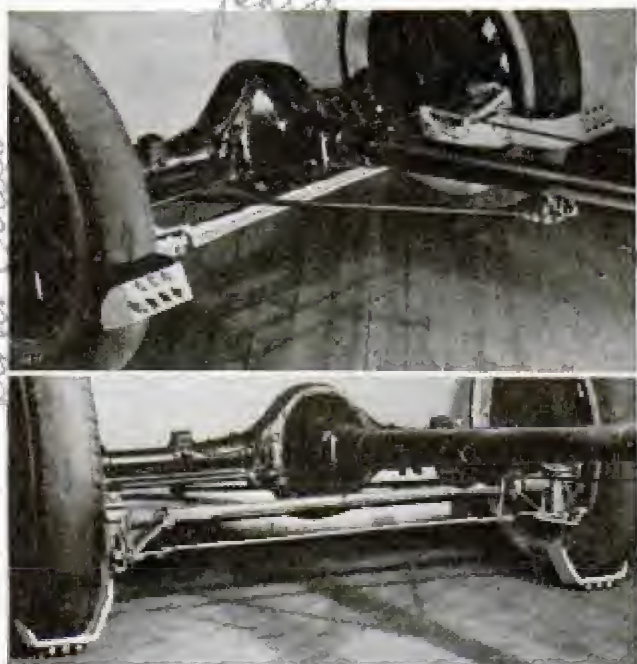
Major McDaniel pulls canvas hood around his seat, leaving only the instrument panel in view as he starts historic flight

Auguring air travel in the future heedless of weather, an army air corps pilot in the hooded cockpit of a four-motored "flying fortress" flew the big ship entirely "blind" recently from the takeoff at Mitchell Field, Long Island, to safe landing 300 miles away at Langley Field, Va. Canvas shut out the view from his windows. All he could see was the instrument panel and the controls. The pilot, Maj. Carl B. McDaniel, with his eyes on the air-speed and rate-of-climb indicators, the "artificial horizon" and the directional gyro, opened the throttles, held the ship on the ground until air speed read 110 miles an hour, then tilted the nose up. The plane leveled off at 4,000 feet and headed over the coast line for Langley Field. Radio contacts were maintained, but the course could have been laid by celestial navigation. As the landing field was approached Major McDaniel worked out a conventional orientation problem on the radio range signal. Then at 800 feet

from the airport a bulb on the instrument panel lighted. He tuned to the frequency of another radio marker beacon at the airport's edge and the bulb flashed again. Five seconds later the wheels hit the runway with a slight bump. A six-man crew and two civilians rode with Major McDaniel on the historic flight, Lieut. W. P. Ragsdale sitting at dual controls with an unobstructed view for safety in case of heavy air traffic.

Spiked Non-Skid Tire Shoes Swing under the Wheels

Skidding can be stopped almost instantly with a pair of non-skid "steel shoes" that may be thrown under the rear wheels of an automobile. The shoes, attached to the inside drum of the rear wheels by means of swinging axles, each have seven sharp steel calks that "bite" into the slippery or icy pavement, driven down by the car's weight on the wheels. A lifting spring holds the axles out of the way in a horizontal position until the driver feels his car going into a dangerous skid. Then he pulls a lever to unlock the device, and the shoes swing downward to engage the road, remaining under the tires until the car stops.



Spiked shoes retracted (top) and lowered under tires (below) to halt the skidding car

Oddities in Gourds Displayed by Craftsmen



That versatile vegetable, the gourd, showed up at an International Gourd Society display in many disguises. At upper left, a flock of gourd penguins; right, a copper-bound vessel with Indian design. Below, a gourd make-up mirror

Odd and ornamental varieties of gourds were shown at a recent show sponsored by enthusiasts of the gourd hobby. Among the novelties and useful articles exhibited

were a makeup mirror and set of earrings, comical-looking penguins, and a copper-bound vase, all expertly fashioned and colored to produce unique effects.

"Test Strip" Enlarging Meter Acts as Automatic Switch

First making a test strip to determine the best exposure time, a combination exposure meter and switch then automatically operates the enlarger light for the correct time. On the test strip a key letter is chosen indicating the portion properly exposed. The timing switch is then set at the same letter, and it turns the enlarger light on and off, allowing print to be made in the dark with exact exposure control.



HARNESSING



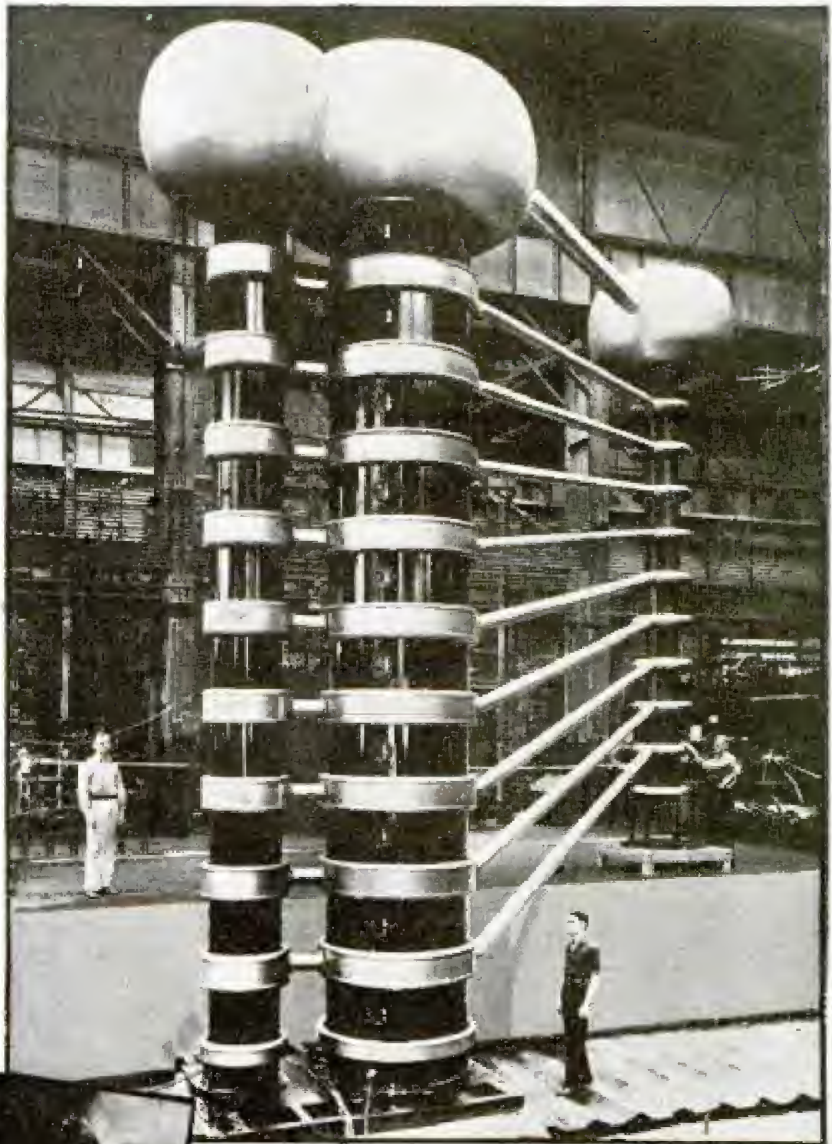
ITS gamma-ray output equal to that of \$150,000,000 worth of radium, a 1,400,000-volt X-ray tube more than twenty-eight feet long is being completed by the General Electric company for research work at the National Bureau of Standards. One of its important uses will be a study of X-ray dosage. The medical profession has been using 200,000-volt X-rays to treat cancer and other diseases, and the Bureau of Standards will extend research on dosage measurements from this point up to 1,400,000 volts. The tube is mounted vertically in ten sections of 140,000 volts each. The electron beam must be aimed accurately to hit the target at the base, twenty-four feet below the cathode, without striking the glass walls of the tube or the various metal accelerating electrodes. Starting at zero velocity the beam is given an additional 140,000-volt "kick" as it enters each new section, and when it reaches the target it has the 180,000-miles-per-second velocity and the energy it would receive from a single 1,400,000-volt "kick."

Top, three of ten sections of the tube, each rated at 140,000 volts. Left, electron gun, cathode portion from which electrons plunge toward target. Below are the corona shields.



1,400,000 VOLTS

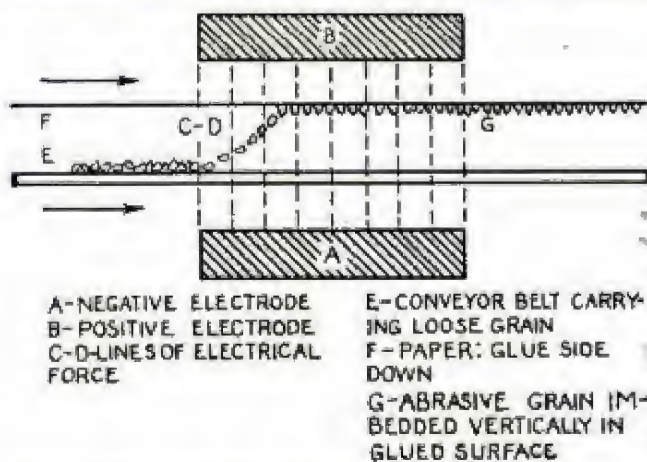
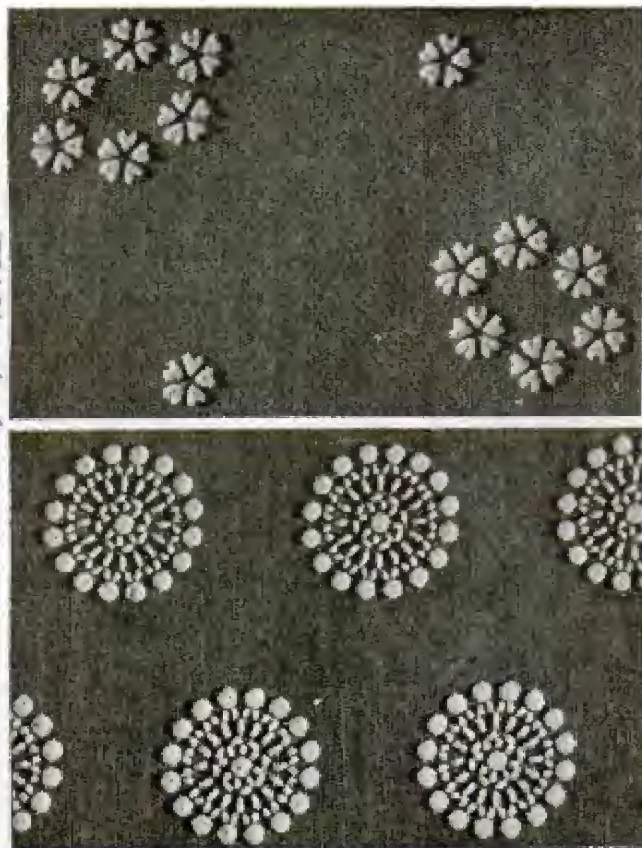
The generator furnishing power is also built in ten sections rated at 140,000 volts each, and forms a stack thirty-two feet high. A similar stack of resistance units is used to measure the voltage. Over the two stacks will be a corona shield of spun aluminum to prevent discharge of electricity into the air; another corona shield surmounts the X-ray tube itself and doughnut-shaped corona shields surround each section of generator and tube. The tube's envelope of ten glass cylinders placed end to end will be shielded mechanically against breakage with a strong envelope of insulating material along its entire length. The tube can be operated at any voltage down to 300,000, a flexibility highly advantageous for the research work to be undertaken.



The 1,400,000-volt X-ray tube is enclosed in column at right of picture above, and connected to high-voltage direct current generator by long aluminum tubes. At left, the "end of the trail" for an electron beam at bottom of big tube. Below, cathode filament (left) and target of tube



K 895 **'Static' Prints Cloth Pattern by Polarizing Fiber Tufts**



Top, raised patterns "polarized" on fabric; below, diagram of similar method used in making sandpaper

Several years ago "artificial lightning" was put to work standing abrasive crystals on end to produce a better sandpaper. Today the process, originated by Behr-Manning Corporation of Troy, N. Y., is being used to "embroider" tufted patterns on dress goods and to coat fabrics with "polarized" fibers for automobile upholstery. In the past, fibers ground to random lengths had been applied simply by dropping them on cloth bearing patterns of printed adhesives, letting them affix themselves as they would; but the electro-coating method uses a 50,000-volt force to make

these minute fibers—accurately cut to lengths of twenty to sixty thousandths of an inch—stand erect as they are deposited on the cloth, creating a uniformly raised pattern. As in the sandpaper-making process, the cloth and fibers pass between positive and negative plates and as the fibers are drawn to the cloth they line up with the electrical field. Tests of these tufted materials indicate they will endure rubbing, both dry and in the laundry. An even later development is the production of a completely coated pile fabric somewhat resembling velvet or suede, as many as 300,000 fibers to the square inch being deposited on a special rubber latex adhesive backing, the artificial lightning assuring perfect orientation of the fiber particles. A possibility of the future is the electrostatic production of velvetlike rugs.

K 369 **Drinking Fountain for the Sink Clips on Lip of Faucet**

You can have a drinking fountain in your kitchen, bathroom or laundry by fitting the faucet with a clip-on "bubbler." No special fastenings are needed, and when the cup is not in use it can be slid forward so it will not intercept water.



Drawing shows how the attachment converts the faucet into a bubbling drinking fountain

Giant Statue Given Make-Up by 'Human Fly'

Caught by a camera-
man while a painter ap-
plied a facial "beauty
treatment," the huge
statue "Pacifica," at the
Golden Gate Internation-
al Exposition, assumes a
strange attitude. With
hands raised, the figure
appears ready to strike
the "human fly" workman.



Painter, dwarfed by colossal statue, "Pacifica," as he beautifies her fea-
tures, appears in danger of being crushed between the huge hands

Moist Wick Keeps Tobacco Fresh in Pocket Humidor

Tobacco is kept fac-
tory-fresh in a "pocket
humidor" containing a
specially treated wick.
Water is injected with a
filler bulb through a port
in the side of the pouch,
and evaporates slowly
from an exposed portion
of the wick at the bottom.
No free water touches the
tobacco. A metal ball
seals the filler port.

Ice-Top Table for Serving Food Keeps Cold Dishes Fresh

For restaurants and clubs that serve cold
meats and salads at help-yourself tables,

like those of the Scandinavian variety, an
ice table is now available to take the place



Refrigerated table top provides level surface of ice to keep a variety of
cold foods chilled at restaurants where patrons serve themselves

of ice blocks, which some-
times permit heavy dishes
to slip off. It has a large
oval top finished in chro-
mium and rimmed with a
metal strip rising two
inches above the surface.
Refrigerating pipes im-
bedded in the upper part
cause condensation of wa-
ter from the air to freeze,
forming a two-inch sheet
of ice which becomes the
actual table top. When
trays of food are placed
upon this level surface
they will remain cool as
long as the built-in re-
frigerator unit is kept in
operation.

Voice Titles for Silent Films Supplied by Automatic Timer



Notches in movie film start and stop sound record during projection, top; below, putting titles and sound effects on record

Voice titles and sound effects can be added to silent home movies with a simple timer that starts the phonograph at the right places. The timing device, containing delicate switches that control the operation of the phonograph turntable and amplified loud speaker, is set up in conjunction with the projector so the film runs through it. Small notches cut into the film at scenes where sound is desired trip the switches, thus giving the starting and stopping orders. Either old or new films of eight or sixteen millimeter size may be used in the timer, and it operates with any projector and recorder-phonograph.

Moon Once Rested in the Pacific Glassy "Tektites" Indicate

Thousands of glassy "tektites" found along southwestern shores of the Pacific are regarded by Dr. Carl W. Rufus, Uni-

Astronomy Dept. Ann Arbor Mich.
versity of Michigan astronomer, as confirming evidence that the deep Pacific is a scar left when the moon tore away from the earth. Dr. Rufus theorizes that the earth was then made up of an upper layer of granite and a lower layer of glassy basalt. When the moon broke away it took a mass of granite from the Pacific area, and probably some of the glassy layer. Particles of this glassy material, the scientist believes, were later drawn back through the earth's atmosphere at speeds sufficient to produce the tektites in their characteristic forms. Tektites have been studied for more than a century but no agreement on their origin has been reached.

Umbrella Carried in Pocket of Woman's Handbag

Bigger handbags for women afford space to carry more accessories, one of the latest being fashioned with an extra compartment at the bottom to hold an umbrella. When needed, the umbrella is unsheathed readily by opening a slide fastener.



Stowing away the umbrella in a special compartment at the bottom of the oversized pocketbook

K 7-6. Cross James St. & 9th St. Kansas City, Mo



Columbia National Forest Radio Station

RADIO to the RESCUE



LIGHTNING strikes a high-tension wire and burns it in two. Out go the lights in homes and shops, but more important than the disruption of service are the dangling ends of the wire—a threat to public safety.

Word of the break, though perhaps not its exact nature, reaches the system operations department of the power company quickly. The engineer at the control board glances at a map on which numbered disks have been placed to show the positions of trouble crews on duty, then picks up his radio telephone: "Dispatcher calling Trouble Car Four . . . Dispatcher to Trouble Car Four . . ."

The driver of a trouble car, cruising in the vicinity of the re-

Spauld Hall
Top, using radio on forest fire line to maintain contact with headquarters. Center, power company crew receiving emergency orders. Bottom, two-way radio enables police to reach scene of crime within a few minutes after headquarters notification

Ref: U.S. Forest Service, Washington, D.C. Conservation Section, State of Indiana. see next page



Left, ultra-short wave receiver of type used to bridge gap in telephone service. Right, patrolman about to make call over two-way radio. Circle, using handset on New York fire department launch

ported difficulty, answers and receives the order: "Hop over to Fourth and Pine and repair a service break. Let me know if you need any help—that's all."

The trouble shooter hurries to the location but upon learning the extent of the damage, calls the dispatcher so a maintenance crew and a new pole can be rushed there. The dispatcher, using radio, contacts a crew in the field in order that power service can be restored quickly and repairs made before pedestrians are endangered

by the live-wires. Use of short wave by utilities and others in emergency service is just beginning to emerge from the experimental stage, yet it's regarded as one of the outstanding contributions to public safety.

When the Federal Communications Commission first allocated frequencies for this purpose, power companies in Detroit, Philadelphia, Wichita, Kansas City, Kan., South Bend, and Fort Wayne were among the first to apply for licenses. Operations are expected to be started at Louisville, Baltimore, and Kansas City, Mo., shortly.

Short-wave radio fits into the utility service picture in a number of

ways, an important one being in connection with the switching operations necessary following a breakdown in a particular district. No matter what the cause of the line trouble may be—lightning, broken tree limbs, or sleet—the circuit breaker at the substation from where the power is coming automatically opens, cutting off the electricity. Power systems are set up with sectionalizing and emergency switches so a trouble spot can be segregated and service restored to the unaffected districts as

new...
less of I and...

K 7:6



soon as possible. Upon learning of a breakdown in a particular area, the system operator usually dispatches a trouble car on a reconnaissance trip. The trouble located, the driver calls the dispatcher by radio, acquaints him with the details, and then waits for instructions on the location of the switches that are to be opened on either side of the break.

Spotted along a great natural gas pipe line extending from Texas to Chicago are six portable radio-telephone stations, ready to bridge any gap in the private or leased telephone facilities that might occur in Nebraska, Iowa, or Illinois. Should a sleet storm or flood stop the flow of messages over the regular channels, the complete radio units serve as relay stations at each pumping station. In a pinch the sets can be used to reach points that otherwise would be inaccessible. In the event of a washout or something equally serious, a fleet of repair cars and trucks can be mobilized quickly.

When flood waters, a hurricane, tidal wave, and fire swept large areas of the northeastern states a few years ago, short-wave radio proved such a vital help in furnishing

(Continued to page 122A)



Top, left, small-size radio-set developed by U. S. Forest Service for fire-control work. Right, operating Kansas City, Mo., police radio system. Keys on control desk operate lights on map as information comes in by loud speaker. Circle, radioing measurements of forest-fire danger. Bottom, receiving instructions by radio from plane hovering over forest fire

Radio Lab. Portland

Plaster Teeth to Fit a Giant Used in Dental Studies



This oversized set of demountable plaster teeth is used in the teaching of dental technique

In observance of the 100th anniversary of organized dentistry, Los Angeles dentists arranged a display of the modern technique of their profession. One of the unusual exhibits was a huge set of plaster teeth, used in teaching dentistry.

'Helm Indicator' on Seaman's Car Shows Position of Wheels

Feeling pretty much "at sea" behind the wheel of his new car without navigating



Retired seaman had this "helm indicator" installed in his car so he will always know position of wheels

instruments, a retired ship's captain ordered a special "helm indicator" installed beneath the steering wheel. The dial shows the position of the car's front wheels, just as the position of a ship's rudder is indicated for the helmsman, enabling him to maneuver with better judgment in close quarters.

Extra Filament in Headlight Bulb Switches on Automatically

Double-filament bulbs for automobile tail and head lamps are available this year. When the first filament burns out the emergency filament is automatically switched on. At the same time a signal on the dashboard tells the driver he is using the second unit.

Music Flows from Flying Pigeons with Whistles Tied to Tails

Musical notes issuing mysteriously from pigeons as they soar through the air have caused some amazement among neighbors



Music takes wings when pigeon fancier fastens tiny instrument to one of his birds and sends it aloft

of one fancier in New Jersey. The feathered musicians, without talent of their own, wear a set of whistling devices fastened to their tails. Consisting of reed and silk poplin, mounted on an ivory tongue, the tiny instrument produces musical sounds when it is whisked along in flight.

K 474 Ref: Chief Radioman
Harold A. Williams

Colored Lights on Map Show Flying Weather

Weather conditions at airports are read at a glance on an electric map that illuminates colored dots designating the airports. Developed for use at the Naval Reserve air station at Floyd Bennett field, the "weather billboard" covers the eastern area of the United States. To learn the flying conditions at an airport to which he is planning a flight, the navy pilot turns a switch that makes all the airports glow in colors. If the airport is spotted in green it means that weather conditions are good and he would have visual contact with the ground; white indicates a medium condition which would require flight by instruments, and red, as usual, is the sign of danger, indicating "closed in" or extremely adverse weather at the airport. All the airports are checked daily to keep the map up to the minute. Colored slides are moved into their proper positions by manipulating levers on the control board.



Manipulating lever (top) gives green, white or red illumination for airport to indicate weather conditions. Below, map dotted with lights

Blasts Wreck Large House for Government Building Site



Wreckers made short work of demolishing a tall building in Washington, D. C., by starting at the bottom with blasts of dynamite, instead of at the top. The charges were set under every second pillar to undermine the steel and concrete structure so the ruins would tumble inward. Removal of the apartment was necessary to make way for the new \$26,000,000 war department building.

Apartment building going down in a puff of smoke and dust as wreckers set off charges of dynamite to blast away pillars

ed with 3/5 of children a general
-ology. Postgraduate Center
ment of

President, Better Vision Institute

In the world war the British and French protected the positions of their guns from aerial observation by erecting acres of net tents—tents of dazzle—on which were stenciled masses of color blending harmoniously with the surface of the earth. But the Germans hurled this obstacle by perfecting



Curtiss P 36a.



of DAZZLE

X 106
1st and 2nd Battalions
101st Airborne
Camp
Curtis

color filters which made it possible to distinguish pigment colors from those of natural verdure. Organic dyes, which will defy detection by filters used by either the human eye or the camera, are said to be available today and net tents now used by the French are far superior to those of 1914.

Camouflage in 1940 is a much more difficult undertaking than it was during the world war. All the European nations have made aerial surveys of areas of potential military interest. Thousands of such photographs are catalogued and filed for future reference. If new photographs show changes when compared with those on file,



Wahfeld.
Massachusetts national guardsmen (top) with uniforms and machine gun covered with white sheets, employing winter camouflage of the type used by the Finns. Below, gun concealed from eyes of enemy aviators by foliage-sprinkled net

K 10.6



Warplanes approaching camouflaged anti-aircraft battery in maneuvers (top). Mechanized cavalry vehicle, painted white, blends with snow in Fort Knox maneuvers (inset). Machine-gun crew (center) in white costume for maneuvers over snow-covered terrain at Fort Brady, Mich. Bottom, Dutch coastal defense infantrymen in trenches camouflaged with wire netting covered with pieces of jute, similar in color to surrounding fields and meadows

camouflage will be suspected immediately.

Development of aerial photography has stimulated greatly the art of camouflage. Men throughout the world have been working valiantly to disprove the old saying that "the camera doesn't lie."

Aerial photographs record the earth's surface in masses of light and shadows. The camouflage artist aims to produce conditions that will deceive the camera. The perspective of aerial photographs is vertical. In ordinary life the eye sees objects in a nearly horizontal plane. A cultivated district is seen from the air as a checkerboard of fields divided by hedges. Conglomerate land areas, containing demolished villages, shelled areas or patchy vegetation, present highly complex patterns, offering an excellent opportunity for the light-and-shadows camouflage technique. The camouflager studies the landscape from photographs and plans his work accordingly. It is important that the perspective lines of the locality be duplicated in the camouflage. The work must harmonize with the contours of the district, otherwise the deception will be apparent readily in a photograph, as for example, in one taken when the sun

is low and objects throw long shadows. A mound must be a mound, and a flat surface must be a flat surface; otherwise their shadows will betray the deception.

Plans for the detection of camouflage by the use of stereoscopic methods have been developed. Hundreds of aerial photographs have been taken of potential battle areas. When a photograph of a section is placed on one side of the stereoscope, and a recent photograph placed upon the other side, if the contour of the land has been disturbed by erection of works, it will show up as an irregularity to the eyes of the investigator. Thus has the optical plaything of a past and simpler generation been converted into a device of warfare.

Most familiar to the general public is the camouflage of ships. By painting irregular shapes on a ship its silhouette is blurred, thereby making accurate aim of missiles from submarines difficult. In the last European war the use of camouflage is said to have reduced materially the marksmanship of submarines.

During the past ten years considerable study has been given to the development of scientific principles of ship camouflage, with the result that not only can vessels be made very blurry in form and outline, but they can, through the clever use of optical illusions of line and mass, be made to appear running a different course than they actually are. The submarine commander, thinking the ship is about to turn from its course, aims his torpedo accordingly, and frequently will miss because of the optical illusion of the ship's movement.

Zigzag steering of vessels is a deceptive stratagem which is now used extensively in the war zone. The aiming of torpedoes, as other modern military projectiles, involves highly complicated mathematics. If a ship changes its course even slightly the calculations are rendered valueless and success in hitting the vessel with a torpedo becomes largely a matter of luck. Automatic zigzag steering devices have been perfected and are now being used extensively, and are supplanting to a large extent the painting of optical illusion designs on vessels.

Much camouflage, both terrestrial and naval, is made to reduce visibility. A dirty gray battleship is less easily seen than is a black, or brightly colored ship. Some camouflagers believe that if a ship is painted

(Continued to page 120A)

JULY, 1940

480 Fingers Massage Scalp to Keep Hair Healthy



Crowned to fit head, multiple disks with 480 fingers massage scalp to remove dandruff and loose hair

To stimulate blood circulation at the surface of the scalp and remove loose hair, scale and dandruff, a lightweight massager with multiple disks works quickly and gently. Its 480 flexible fingers are manipulated automatically as the user moves the machine about his head to massage all of the scalp muscles.

Umbrella Stands by Itself to Dry on Broad Plastic Base

Able to stand on its own, an umbrella now on the market is capped with a flower-shaped plastic pedestal at its tip. Instead of laying it on the store counter while shopping, or leaning it against a wall at home, the user may set the umbrella upright, either opened or closed, on any convenient level surface.



Lord and Taylor's

K 394.

Section Operation Officer.

Aerial Map Untangles Traffic for Air Students



Before a training flight, student pilots at Kelly Field turn glass disk on "Trafficgram" to match wind, then read traffic directions on map

Traffic in the air above Kelly Field, a serious problem with 224 army air corps students making frequent training flights, has been safer since the "Trafficgram" went up on the wall at headquarters. It is a five-foot square aerial map of Kelly Field on which restricted and danger areas are marked. Pivoting about the mid-point of the airport is a glass disk on which are printed the rectangular courses the students must fly. Before taking off on a flight, the pilot turns the disk so that its index matches the wind direction, then reads on the map the exact traffic pattern, takeoff and landing lanes he must use.

Slag Converted into Bricks Has Many Uses in Building

Slag from blast furnaces, a waste by-product that rises to the surface as iron is melted, is being used in the manufacture of building blocks. Discovery of a process that expands hot gases within the particles of slag, creating countless tiny sealed cells, made possible its conversion into watertight, lightweight bricks. They may be pre-cast, or the particles can be mixed with cement and poured into shapes on the job. Its cellular structure gives the product insulating value without impairing its rocklike strength. Nails can be driven into the blocks for fastening frames and studs. Since they can be painted or plastered without extra covering, the blocks find use in wall partitions, floors, roofs and ceilings. In small buildings the block presents a good appearance for both inside and outside wall faces. In loose form the particles make fireproof in-the-wall insulation for buildings.



Top, a house made of slag building blocks. Below, nails can be driven into blocks for fastening frames and studs

Waylita Co. 1900 W. Madison
Santa Clara, St. San Antonio, Tex.
Cmt. La. W. Steple 408

*K137 Cmt. James Mc Sweeney
9846 St. St. Kansas City
mo*

THEY MOVE ANYTHING



Fremont Bridge.

*Isorge
Washington
memo*

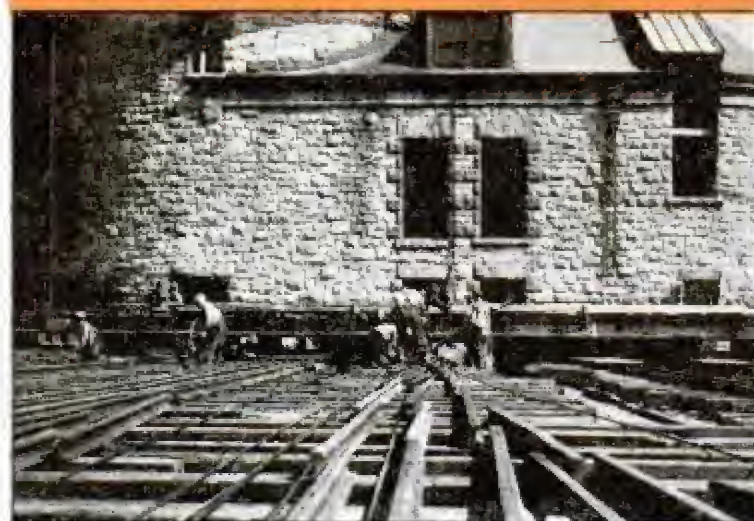
*C. C. Casad, City Engineer
Fremont, Wash.*

IT WAS no ordinary job, this picking up of an old stone observatory and setting it on a new foundation 700 feet away.

John Crowe realized this the moment he saw the fifty-one-year-old landmark of the Northwestern University campus. And he's no stranger to tough jobs. With his brother, Albert, he's been drawing them for years: the assignment of raising the Louisville power plant twelve feet six inches when the city was without lights following a flood, and carting a Minneapolis library building several blocks without even disturbing the books on the shelves, to name but two. On another occasion they sliced a large Chicago church in two and so arranged the halves that thirty feet of additional space could be built into the center of the structure.



Moving a house across Puget Sound by barge, top. Below, five-foot section of skyscraper is cut out and building rejoined



Moving the observatory, however, presented new problems. It wasn't the building's 2,200 tons of weight that complicated matters so much as the nature of the structure. It was two moving jobs rolled into one and called for hair-splitting accuracy.

Extending from the roof to the basement, some forty feet, was the brick base of the telescope measuring thirty feet in diameter. Built independently of the structure proper, it had to be moved at the same time and with infinite care so the delicate astronomical instruments, left in place during the move, were not rendered inaccurate. The 150-ton pedestal must not get more than a fraction of an inch out of line with the rest of the building.

With the same care a structural engineer exercises on a set of bridge plans, the movers worked out their blueprints. The principal factor in moving buildings, Albert Crowe points out, is estimating the load and then seeing to its proper distribution during the operation. Before attempting to move the huge stone pile and telescope base, the movers decided to raise them four feet so heavy timber and steel braces could be inserted under the whole load. Pump and screw type building jacks could then be spotted around and under the building so the weight could be equalized, and by turning the jacks in rotation the building could be lifted without any portion getting out of plumb.

A ditch was first dug around the foundation and openings were made in basement walls to allow the insertion of heavy eyebeams from one side wall to the other. This completed, additional beams and steel rails were placed across the supports to keep the weight even during the move. A crib of heavy stringer timbers was built up in the ditch to a height where

It took two months to move observatory of Northwestern University 700 feet, one tractor and four horses furnishing power. At left are various steps in operation. At bottom, laying rails to keep weight even



600 jacks could be set in place. At a whistle from the foreman, workmen gave each jack a quarter turn, eight quarter turns being required to raise the building an inch.

When the building was ready to start the trip, a bed of big timbers was laid to the new site. On these were cemented six rail runs on which hundreds of rollers would move. As soon as the weight was transferred from foundation to track, pulleys and high-gear tractors were harnessed up and the building began to roll at twenty-five feet a day. To check the movement of the pedestal in relation to the remainder of the structure, a transit was kept in use throughout the move.

Building moving isn't an exact science but it might be mistaken for one after glancing at feats that have been carried out. When Los Angeles widened a downtown thoroughfare a property owner was on the point of ripping off five feet from the front of his thirteen-story office building to allow for the new roadway when George R. Kress, a moving engineer, came along with



The grandstand was moved a half block, the farm house ten miles. Below, high-voltage wires are carried over huge tank as it crosses highway

a better plan. Why not carve out a piece several feet back of the front and then move the facade back intact? This was found much less expensive than ripping off the structure's face and building a new one. Cutting the slice out of thirteen floors of brick and concrete and getting the mov-

(Continued to page 116A)

K421

Inclined Track Lifts Stretcher to Window of Hospital Train



Hospital car in the Netherlands is equipped with inclined track on which stretchers bearing wounded soldiers can be hauled aboard comfortably

To put wounded soldiers aboard hospital trains quickly and with the least possible jolting, the Dutch army has adopted an inclined stretcher track. The stretcher is laid on the track and hoisted through the window of the hospital car.

Super-Gasoline Adds Fifty per Cent to Engine Power

American chemists have developed a new gasoline called triptan which, in laboratory tests, produced fifty per cent more power than the best aviation fuel hitherto produced. It has not yet been put to work outside the laboratory. The extra power was developed without adding lead, which would increase its power by an estimated

twenty per cent more. Another new fuel called neohexane, already used experimentally in planes, increases their power by twenty per cent.

Meters Test Riding Ease by Recording the Slightest Jar

Not satisfied with human observations alone to detect auto vibration, engineers have developed precision meters that reveal shocks unnoticed by riders, yet might cause fatigue or discomfort. With one instrument the slightest jiggle is converted into a thunderous roar through headphones. Another "vibration meter," which may be held in the lap of a passenger or placed anywhere inside the car, records electrically every motion and also shows its extent. A special indicator measures sideways and includes an analysis of each movement in its report.



Listening to the vibration of an automobile with earphones in which the slightest jiggle or jar is amplified into a loud roar

Ref: J. D. Hossine, National Bureau of Standards, Washington, D.C.

K415
341 Massachusetts
Chrysler Corp. 12 Detroit Mich.

K321

Electric Dust Trap Samples Air for Analysis

For measuring and analyzing dust carried in the air or in fumes, Westinghouse has introduced a portable dust sampler. It works on the principle of an electric precipitator, of the type used in some forms of air conditioning. As a sample of air is sucked into the metal tube, a direct current of 10,000 to 11,000 volts puts an electric charge in the dust particles, trapping them against a grounded cylinder. Then they can be weighed and studied.

Air enters horizontal tube, upper left-hand corner, dust is electrically charged and sticks to vertical tube. Meter near top shows volume of air



K294 Vanes Spin Big Multiple Bomb Casting Out Incendiaries



Vanes at tail of this seven and one-half foot Russian bomb rotate as it falls, spilling out small incendiary bombs

One of the most destructive weapons introduced in the war of 1940 is the multiple incendiary bomb dumped over the wooden cities of Finland from Russian planes. The secret of its operation was learned when Finnish soldiers captured an unexploded bomb. Seven and one-half feet long and two and one-half feet thick, it had projecting vanes which made it spin as it fell, and as it rotated sixty small incendiary bombs sprayed out in all directions, starting fires over a wide area.

K441 Cactus Made into Plastics Similar to Bakelite

Cactus, which is an important source of food and drink for Mexicans as well as for their cattle and burros during long dry seasons, has emerged from the laboratory in the form of plastics having properties similar to Bakelite. Production of the new material is expected to start in Mexico sometime this year.

*no data
more than 1000 ft above ground
guaranteed, 76, 100 ft. to 100 ft.*

Chicago Tribune



Secrets of BIG LEAGUE

By Harry Danning
Catcher for New York Giants

THERE are few thrills in baseball that compare with hitting a home run with the bases full and if I could I'd tell you just how to punch one out of the park. Hitting a baseball is nothing more than an application of simple mechanical principles but no player has ever been able to reduce it to an exact science. A few of the best hitters can call their shots—and occasionally make them—yet only three hits out of ten pitched balls makes you a better than average player.

I'll try to tell you a few things that may improve your hitting although some of my teammates won't agree with everything I say. Even the best hitters can get into a hot



Top, batting practice with portable backstop; holding bat out from body adds power. Below, ready for pitch, hands and arms not cramped to body

*Carl Thomas E. Shinnick Jr.
18618 Malibu Road, Pacific Palisades
Calif. 1468*



BATTING

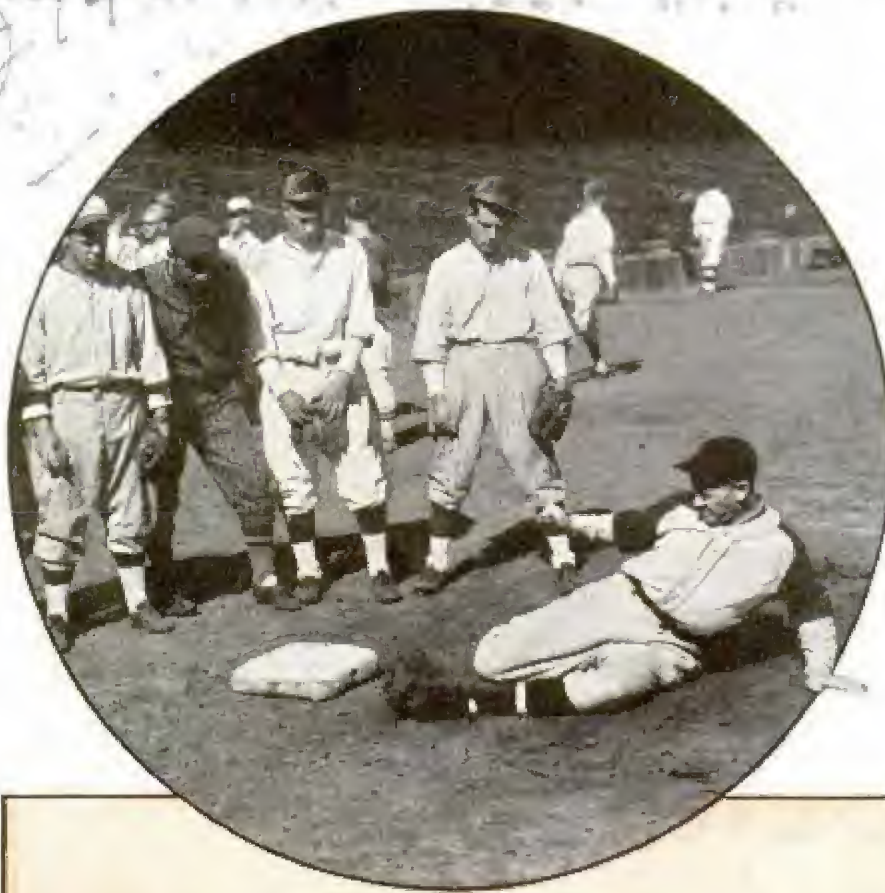
argument as to the best way to hit.

First, it doesn't make much difference where or how you stand in the batter's box. The main thing is to take a comfortable position. The step you take just before swinging is important because it contributes power to your drive and helps with the timing. A long stride will throw you off, so keep it between six inches and a foot long. The direction of your stride will depend on where you stand in the box. If you stand in the far corner you'll probably step forward and in toward the plate. If you stand close to the plate, you may step back or away. If you stride back, move only your leg, because if you move your body back you reduce hitting power.

You should hit off your back foot. That is, keep your weight on it. You can even "plant" that foot by scuffing a slight hole with your cleats. The foot must stand flat until after the ball is hit. Rising up on your toe too soon kills your power and wrecks your timing.



Upper left, in middle of swing, bat head back but arms advanced, batter begins fast wrist motion that snaps head forward. Right, wrist snap has just begun. Below, under-cutting at pitched ball to knock high flies giving the catcher practice



club gets to the plate. That is, rotate your wrists forward to increase the speed of the club head. Don't swing too hard. Babe Ruth was a hard swinger but he was an exception. The best way to hit is with a firm easy swing with lots of wrist motion. Your head should be absolutely still all through the swing.

The swing should be level. Swing from back to front and keep it as level as you can. The bat will probably drop a bit during the swing but that is all right, what we call level and down. Ruth's



In circle, a class of rookies watches a demonstration of base sliding. Below, after a full swing that connected, a batter drops his bat and gets off toward first on his toes

The best length and weight for the bat depends on the individual. You get the best leverage if you hold it near the end. Control is mainly a matter of grip. Don't grip the bat tightly because this locks your wrists. Most good players hold their bats so loosely that you could walk up behind them and lift the bats out of their hands. Of course, you increase the firmness of your grip as you go into the swing.

Get your arms out during the swing and let your wrists "break" fast just as the

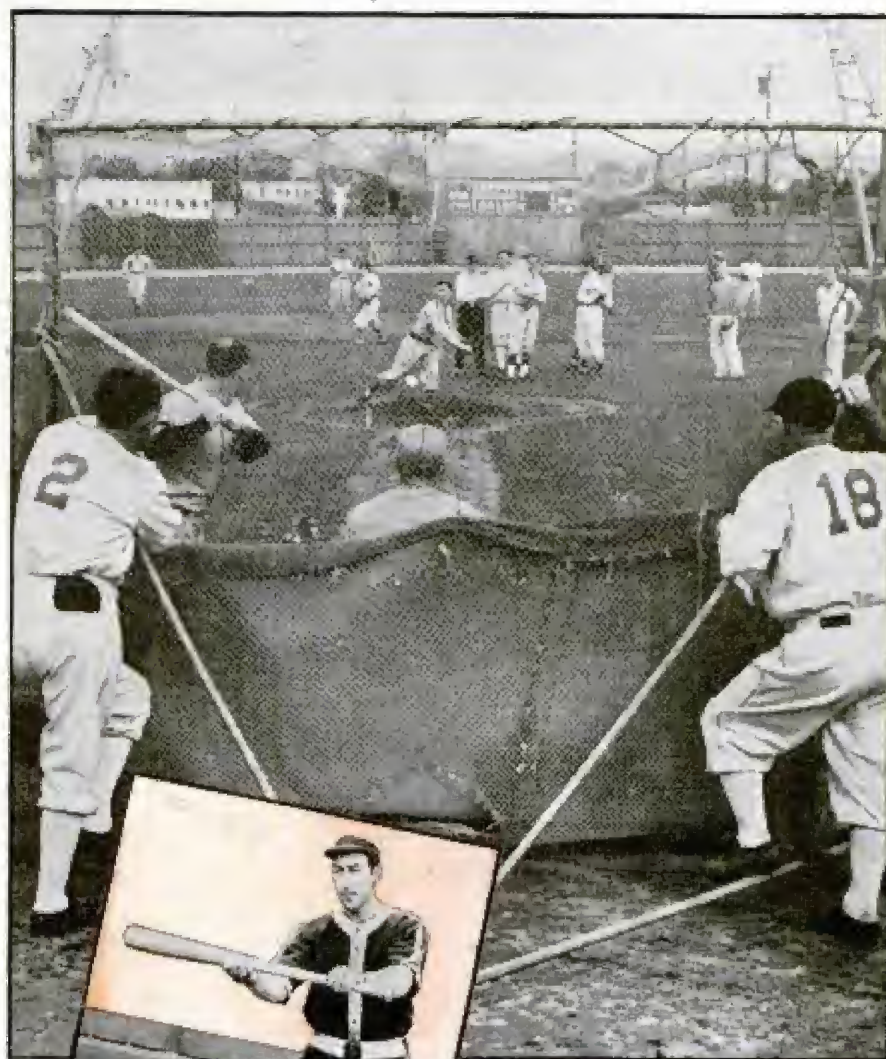
great hitting was due partly to the fact that he was an upper-cutter, but, as I've said, he was an exception. Another good swing, although it's another one you shouldn't try, is the loop. The batter makes a preliminary circle with the tip of his bat before he starts the swing, winding up and gaining terrific leverage and speed. Leave it alone. It takes a strong heavy man to do it properly and no more than five players in the major leagues can control it.

Not even the best hitters can place the

ball just where they desire. They can control direction to some extent although most players fall into one of three classes, the pull hitters who hit to their side of the diamond most of the time, the straight-away hitters who hit to center field, and the opposite field hitters who hit to the opposite side. That's a matter of natural timing with the individual. For a right-handed hitter, a ball hit in front of the plate goes into left field, a ball hit squarely over the plate usually goes into center, and a ball hit a little later goes to right. Try to regulate your timing to these positions. You can help control the direction of the ball by twisting your body and shoulders, pulling around to hit at the proper angle.

If a player had perfect control, which none has, he could hit the ball above or below its center at will. About all you can do is aim at the ball and hope to hit it squarely. That's hard enough by it-

(Continued to page 130A)



Above, batting practice in front of portable backstop used in training. Left, hold bat loosely, thumb behind, for sacrifice bunt. Below, left to right, Danning demonstrates three phases of swing: ready to hit, with bat held loosely in hands; stepping up for straight hit, he snaps the wrists forward; in final position Danning rises on his back foot



Coin Machine Rents Razor for Self-Service Shave

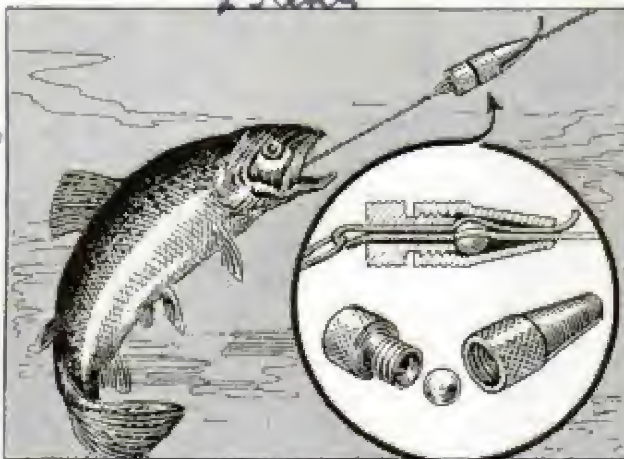


Slot-machine patron shaves self with rented razor, then returns it to receptacle where it is sterilized

Shaves with an electric razor are offered in public places by a coin-operated machine for travelers and theatergoers. The patron shaves himself before a mirror lighted from both sides, then places the razor in a sterilizing receptacle where a germicidal lamp bathes it with bacteria-killing rays. To guard the razor against theft, an alarm is set off if wires are cut.

Ball Lock for Fishing Lines Eliminates Need of Knot

Tying a knot in the fishing line to attach leader or bait, cuts the strength of the line.



Lead ball inserted between two members locks the fishing line tightly and obviates the need for knot

for breaks usually occur at the knot. The need of knotting the line is eliminated by a lock just offered for sportsmen. The line is passed through the eye of the lock, through leader or bait, then back through the lock again; a lead ball is inserted in a socket between the two lock members, which are then screwed together.

Radio Connects Phone Stations If Line Is Down in Storm

Radio now comes to the aid of telephone companies in emergencies by bridging the gap between two exchanges when sleet storms or floods put a long-distance line out of commission. This is made possible with a two-way radiotelephone developed in the Bell Telephone laboratories. When contact by wire is lost between two points, an instrument is plugged into the switch-



Radiotelephone establishes temporary connection between stations that lose contact over regular line

board at each end and conversations may be carried on over the air without interruption, since each unit is both a sender and receiver. The radiotelephone also may be used with a portable switchboard to provide service at remote points.

Laundries are beginning to use invisible marks which can be seen only under invisible light rays, in place of the indelible ink marks or metal tags.

K 398 Northwestern National Life Insurance Co.
Violating Safety Rules Is as Perilous as War



Your chances of sudden death when violating simplest safety rules are about the same as your chances in the war zone. A study of hazards by the Northwestern National Life Insurance company points out, for example, that drinking while driving (above) slows reactions fifty per cent and puts motorist and passengers under the same death risk as riding a contraband-carrying freighter in the North Sea for the same length of time



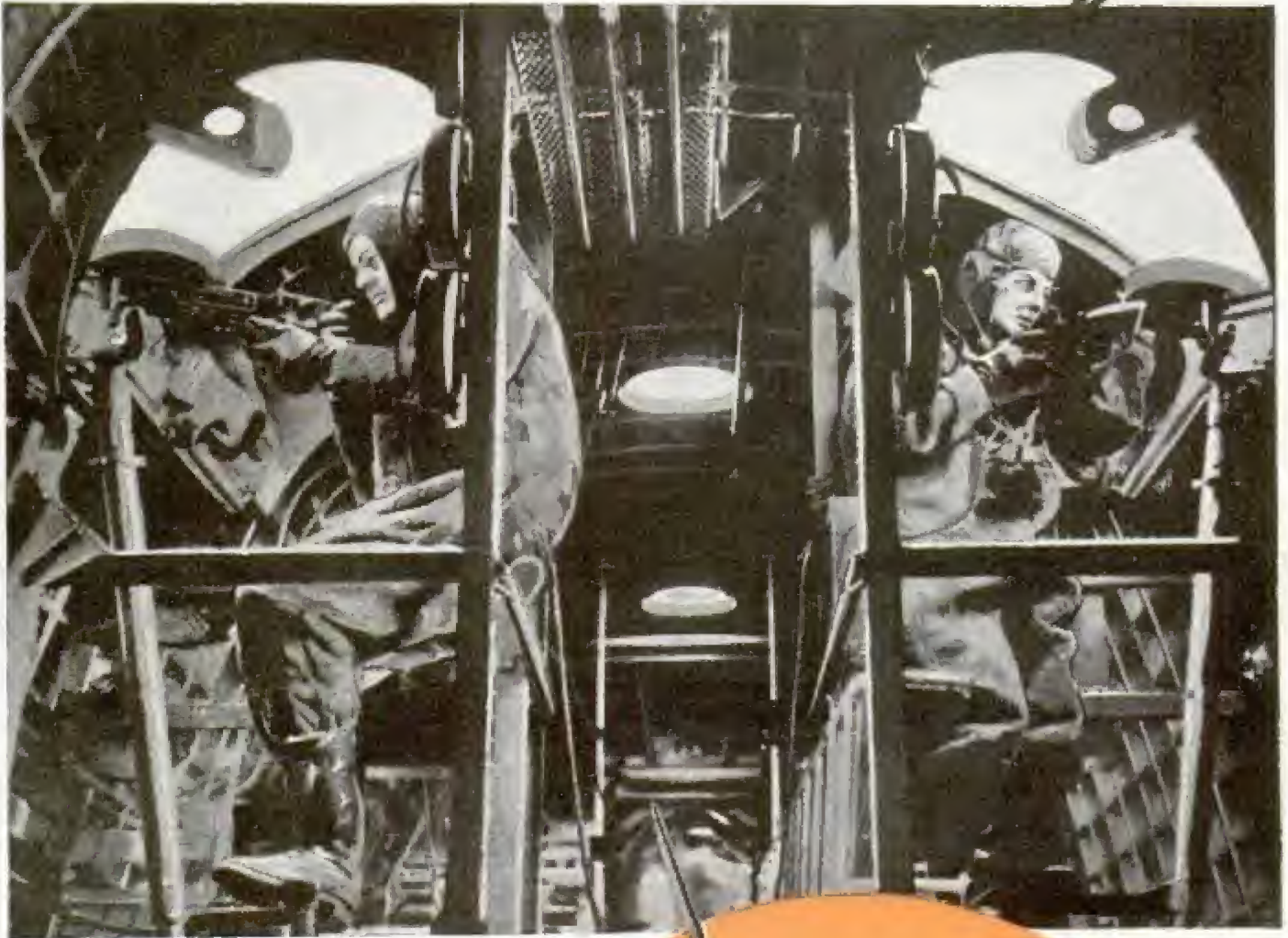
Drivers who ignore stop signs (above) have only twenty per cent better chances of escaping death than a sailor on a British destroyer in an equal period of exposure, accident statistics show



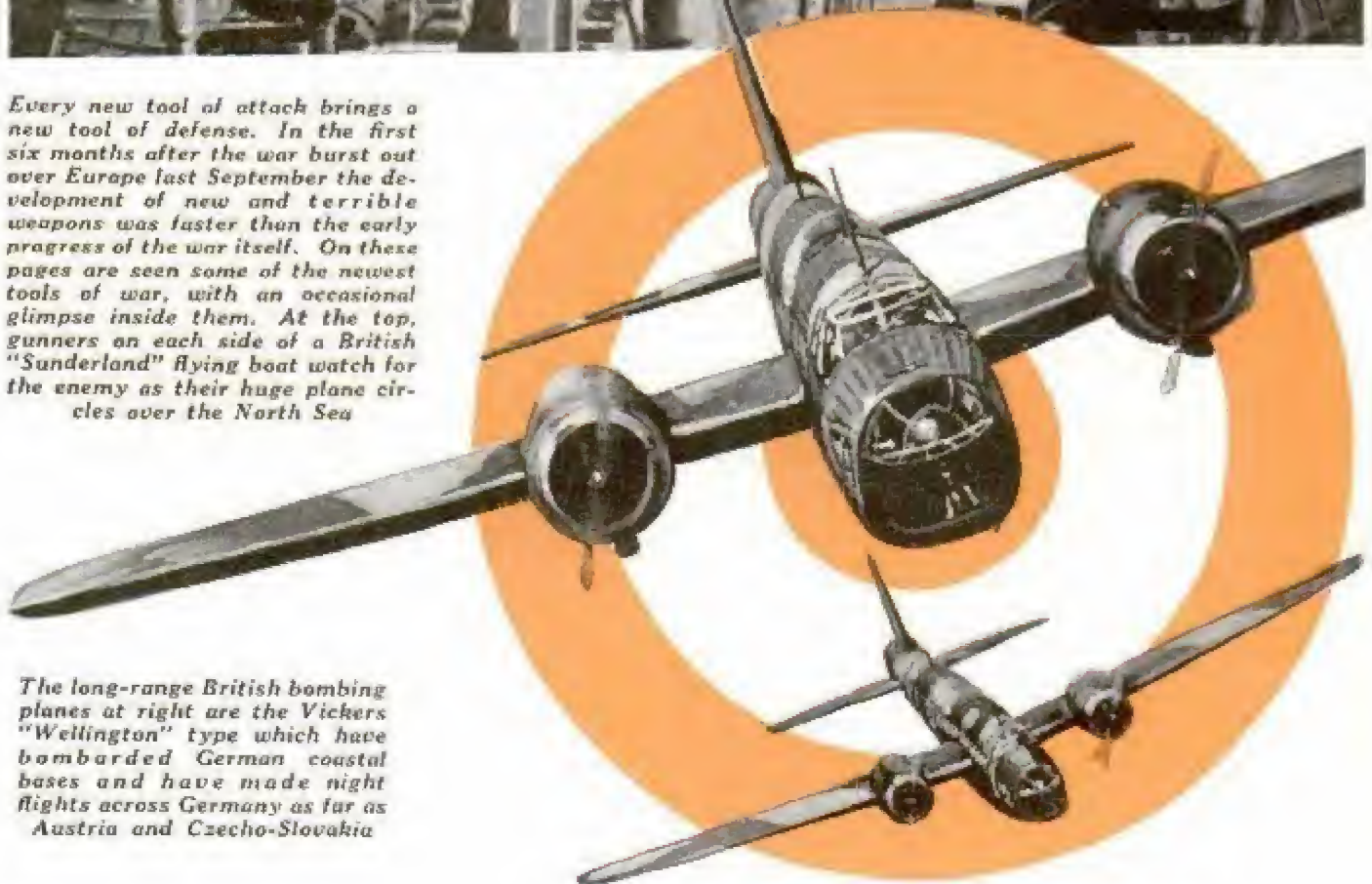
You might as well be in a bombing raid as "jaywalk" across a busy American street in the middle of the block (above). Your chance of surviving the fifteen to thirty seconds between curbs is about the same as in an air raid. And it's twice as risky to clean with benzine, naphtha or gasoline as to learn combat flying at one of the U. S. army and navy air schools



Ki40... acme... TOOLS of

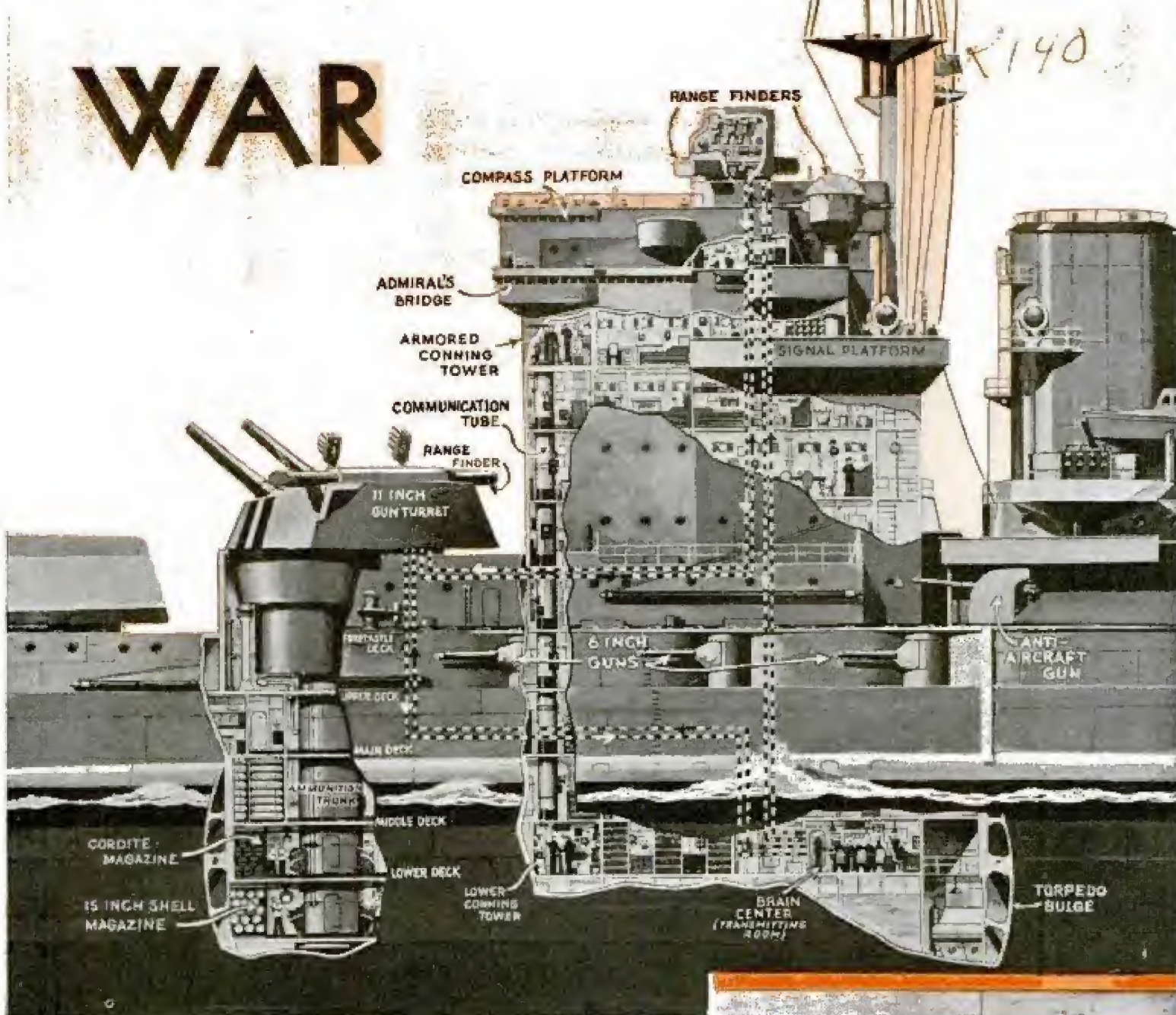


Every new tool of attack brings a new tool of defense. In the first six months after the war burst out over Europe last September the development of new and terrible weapons was faster than the early progress of the war itself. On these pages are seen some of the newest tools of war, with an occasional glimpse inside them. At the top, gunners on each side of a British "Sunderland" flying boat watch for the enemy as their huge plane circles over the North Sea

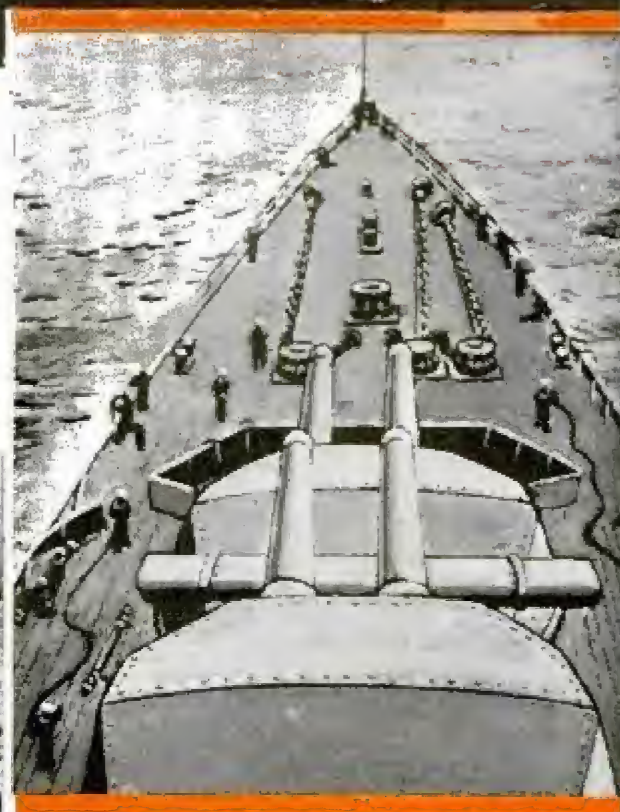


The long-range British bombing planes at right are the Vickers "Wellington" type which have bombarded German coastal bases and have made night flights across Germany as far as Austria and Czecho-Slovakia

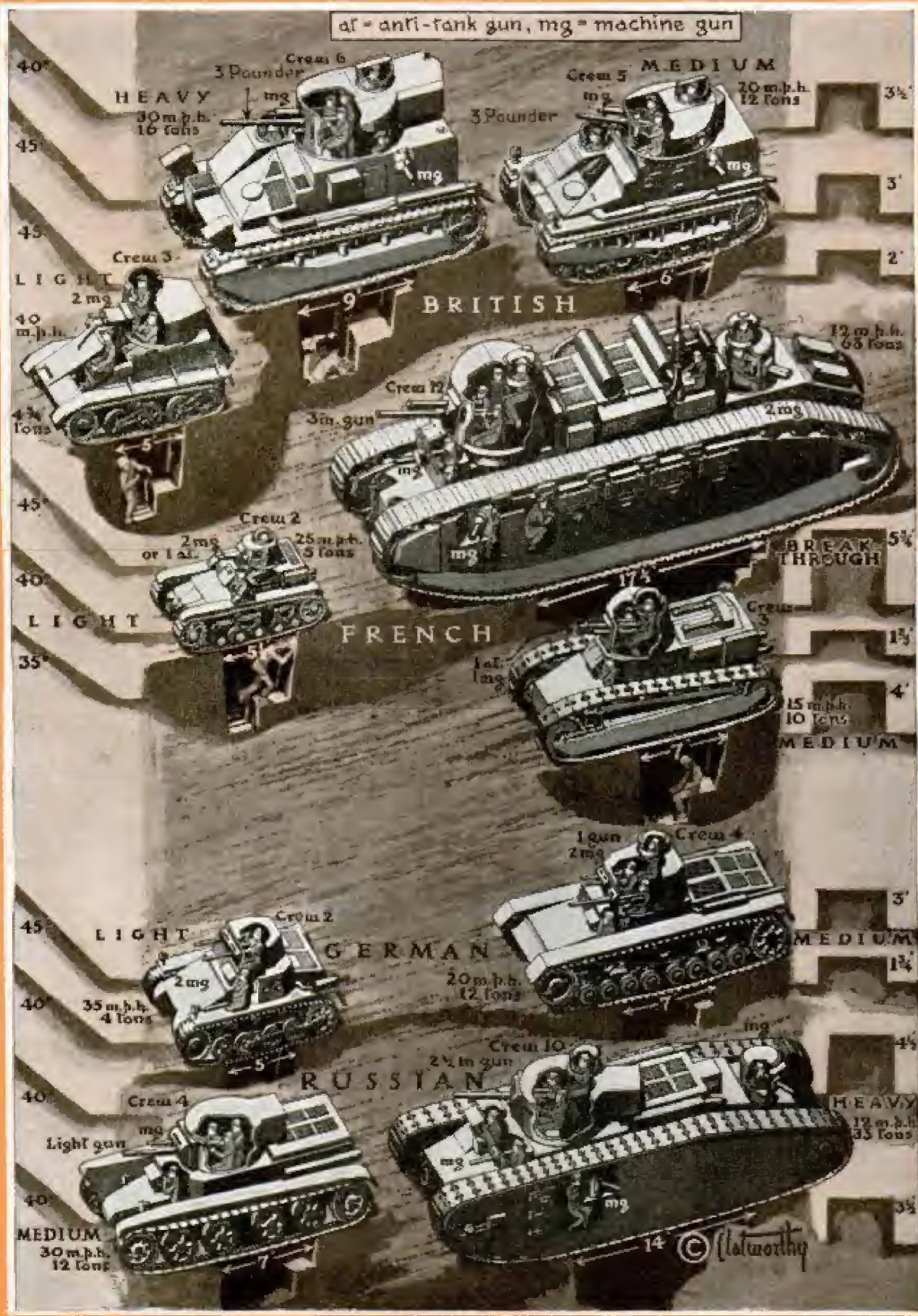
WAR



The drawing above represents the 35,000-ton British battleship "Warspite," whose big guns can fire a broadside weighing 15,400 pounds. Dotted lines indicate the communications system. Here is the routine of firing: position of target and ranges from control top and gun turret are sent to transmitting room; mean range is re-transmitted to control top; training and elevating directions are given to gun turret; guns are loaded meanwhile, and when ready, signal light shows in transmitting room; control top is informed and director-layer fires gun by electric pistol. At right, command, "Clear for action," calls for removal of davits, handrails, etc., and hoses are run along decks ready to fight fire. Below, an amphibian tank finds the going tough

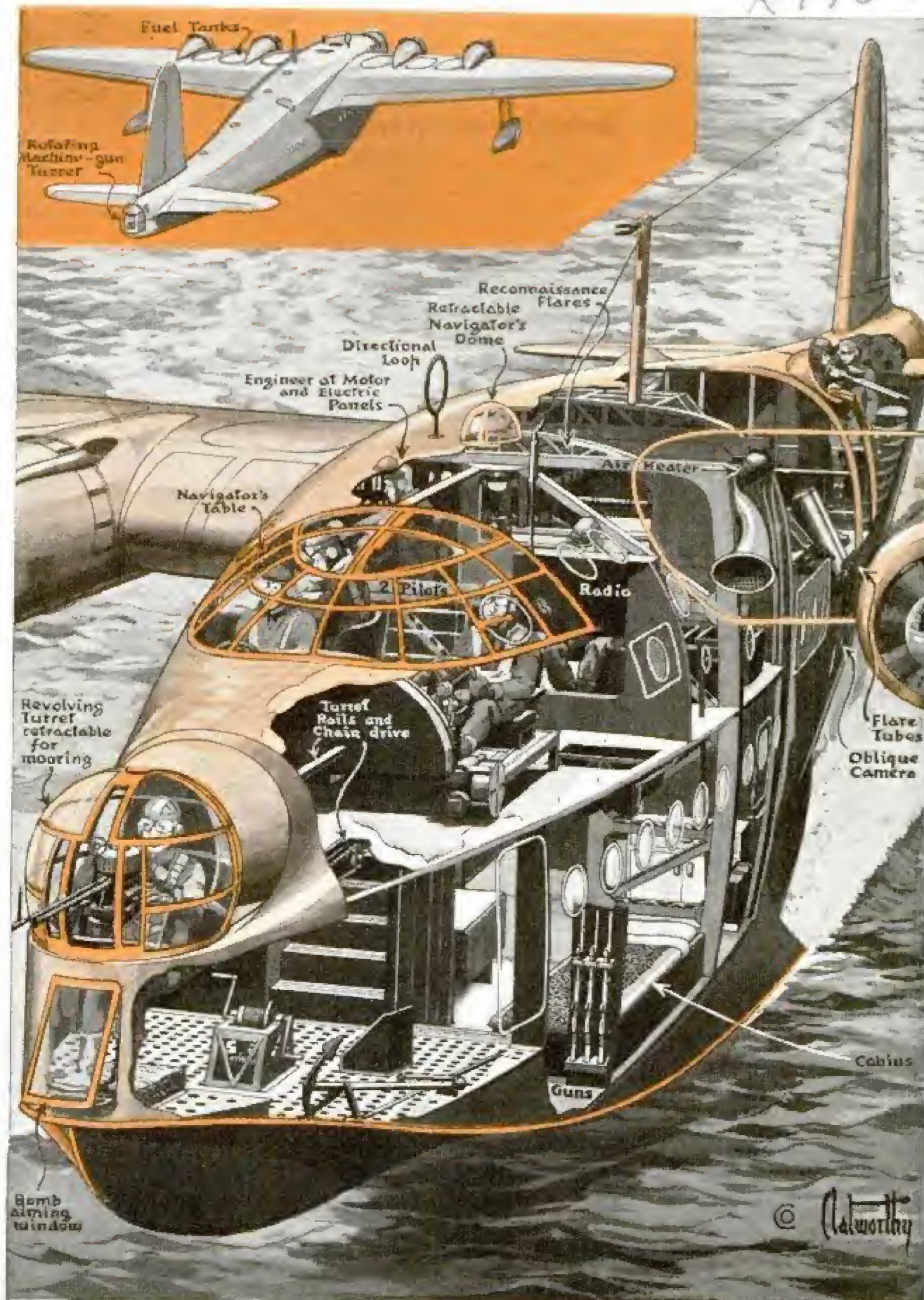


K 140



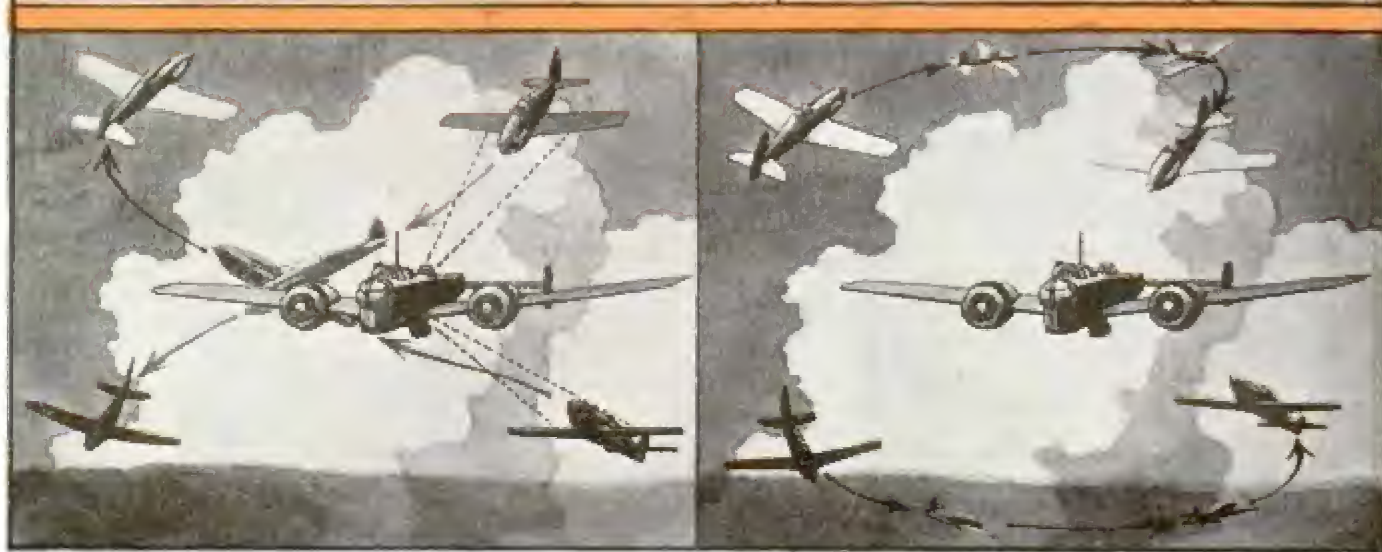
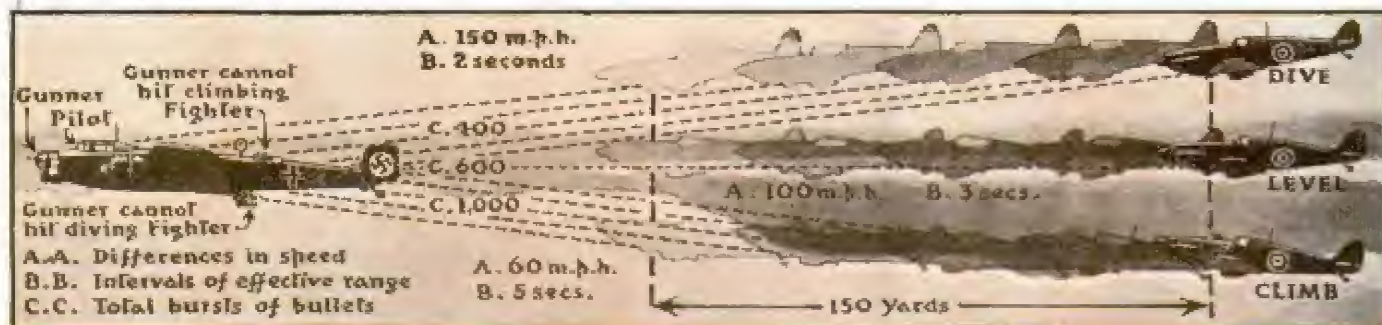
All drawn to the same scale, these are the notable types of fighting tanks of the European armies. British tanks generally prefer speed to thick armor, French the reverse. All have revolving gun turrets, and in each case the driver is between the wheels. Numbers under tanks indicate width of trench the machine can span; down the left side of the drawing are the angles of slope the tank can climb, at right are the heights of abrupt steps it can surmount

K140

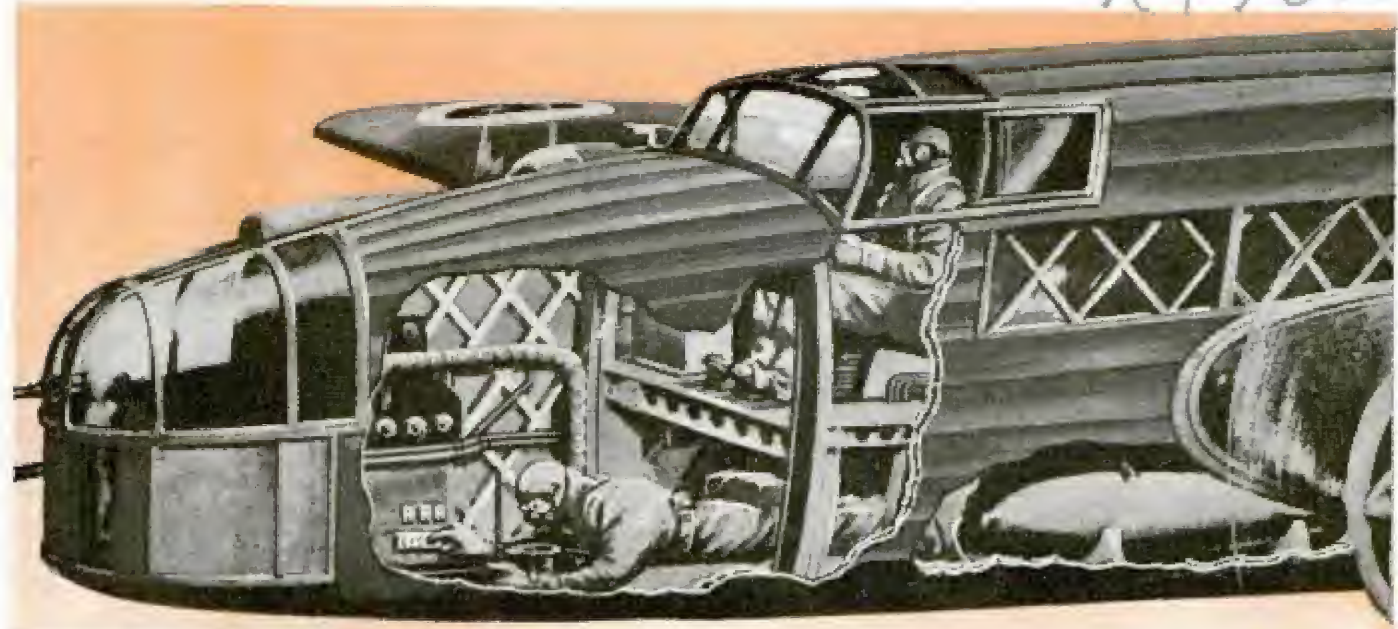


Largest aircraft in the British coastal command is the "Sunderland" flying boat. With a 2,800-mile range, these reconnaissance bombers "cover" the North Sea and northeastern Atlantic. Big enough to pick up the entire crew of a merchant vessel, they have participated in a number of rescues. The four engines develop 4,040 maximum horsepower and cruise at 178 miles an hour, with 22,000-foot ceiling. The ship carries seven machine guns, is manned by a crew of eight

K140



K140



Modern bomb-sighting instruments are extremely intricate. Bomb aimer, above, presses control releasing a bomb as he watches sighting instrument on floor of Vickers "Wellington," British long-range bomber. The sighter automatically takes into account the height of plane, its speed, winds and drift. Sketches at left show three types of bombs and three methods; note steeper angle of fall from greater height

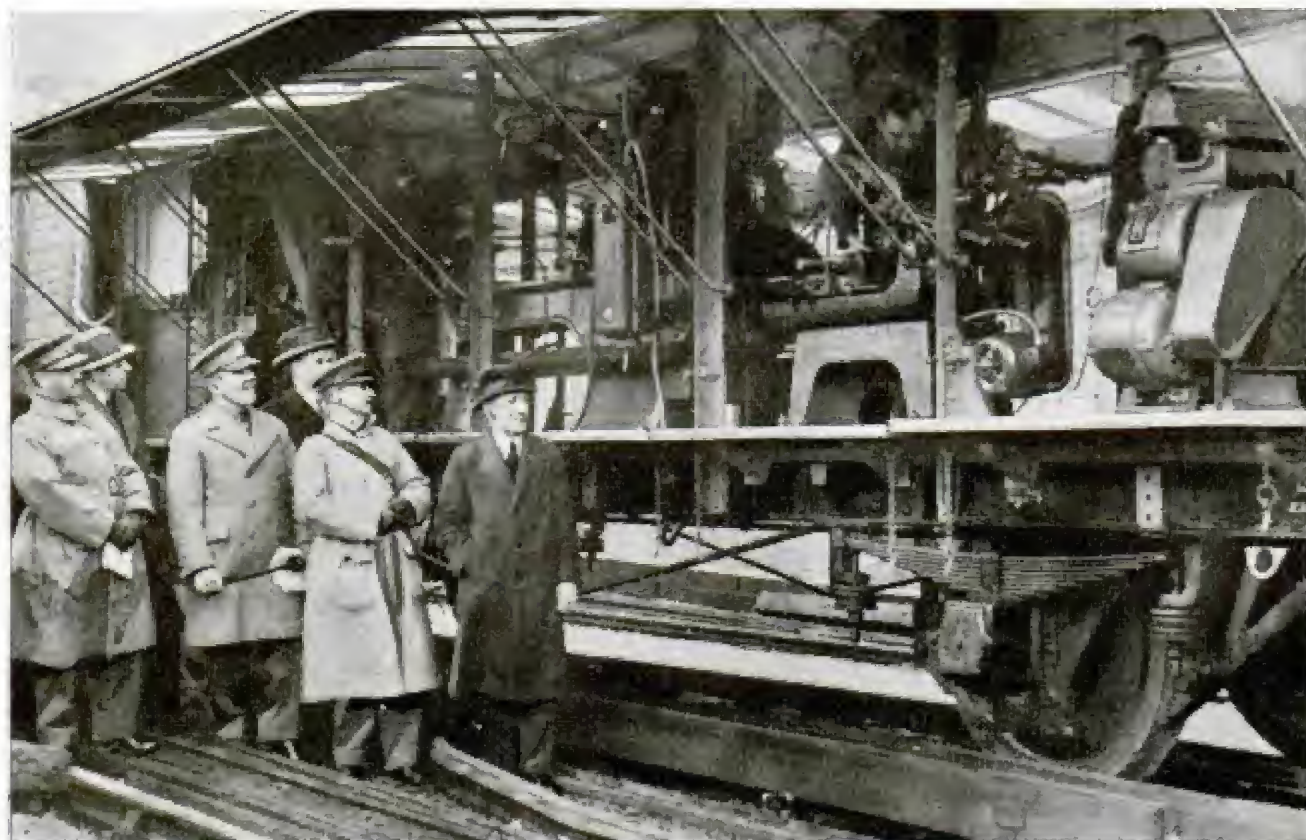


Rolling off its miniature railway track at stern of a mine layer in North Sea, a mine (right) plunges down to join the deadly belt between Germany and England. Below is the "Airacobra," U. S. army 400-mile-an-hour pursuit plane which fires 37-millimeter shell from cannon in nose



2426

Army Shop on Rails Makes Repairs at Front



Officers inspecting British army's mobile machine shop used in France to repair war equipment in the field, thus saving time that would be lost in transporting material back and forth between distant points

British forces in France save time by repairing war equipment in a mobile workshop. By carrying machinery and supplies in a railroad car, many repairs

and replacements are made in the field, thus avoiding the necessity of hauling the heavy pieces to permanent repair depots located far back of the front lines.

110-Foot Laminated Wooden Beam Supports Vast Load

From ordinary two by ten-inch lumber, no piece being over twenty feet long, a Seattle construction company built a tremendous laminated beam 110 feet long, weighing 8,791 pounds and capable of supporting a roof load of sixty-five pounds per

square foot of roof, far above normal requirements. This huge wooden sandwich, resembling a wagon spring, was bonded with 118 pounds of casein glue, only enough nails being used to effect adhesion while the glue was setting. In a test it easily held



Resembling a large wagon spring, this huge laminated beam 110 feet long was built of lumber, no piece being more than twenty feet long, sealed together with casein glue. Here it is under a terrific test load

Speechwall & Seattle, Wash.

Laur Sales Co
314 Maritime Bldg

K 384

a load of 650 pounds per lineal foot. The beam was fifty-two inches deep at its center, ten inches at the ends, and required 3,780 board feet of lumber. Laminated beams are said to be free from checking and so stronger than a solid beam.

Kef 28

Fast Torpedo Boat Built to Defend U. S. Coast

Probably more powerful than similar craft used by foreign navies, the newest type United States torpedo boat, the PT-6, has a theoretical top-speed rating of sixty miles an hour. In the first tests, which were made before its three 1,250-horsepower motors had been broken in, the off-shore defender thundered over a lake at forty-six miles an hour, with no attempt to reach its limit. Manned by a crew of ten, the eighty-one foot boat has a cruising range of 2,000 miles. It is armed with torpedo tubes, depth charges and machine guns, and a single fighting unit costs \$218,000.



Sixty miles an hour is the probable top speed of this eighty-one foot torpedo boat tested for United States navy as new coast defender

Dummy on Wooden Horse Teaches Students to Ride



Instructor illustrates riding lesson for student with aid of wooden horse and dummy rider that can be adjusted to any desired position

Discomforts usually experienced by students of horsemanship are spared beginners at a riding school where instructors use a wooden model as a teaching assistant. Bolted so all the joints move freely, the dummy horse and rider obligingly assume any position desired to point out faults of the novice.

¶ Six flying doctors of the Australian Aerial Medical Service answered 37,554 radio calls for medical aid or advice last year, flying 100,000 miles to their patients scattered over 1,000,000 square miles of back country.

Journal of Aerial Medical 79

Split Mask Compares Tan Obtained at Rival Resorts



Split mask was worn to tan left side of face at Miami and right side at Los Angeles to settle dispute concerning sun tan merits at rival resorts

Differences in the degree of sun tan obtainable at rival beach resorts were compared by experiments made with the help of a split face mask. The wearer spent two weeks basking under the sunny skies of Miami, Fla., with only one half of his body exposed, using half of the queer mask to shield one side of his face. Then he hastened to a beach at Los Angeles, Calif., where he took a second two-weeks tanning on the other half of his body for the sake of comparison. These transcontinental sun baths were prompted by a dispute between two ardent supporters of their respective localities.

Electric Lock for Auto Gas Tank Operated from Driver's Seat

Opened by pressing a push button on the instrument board, an electrical keyless lock for the automobile gasoline tank will operate only when the ignition switch is on.



Disk with adjustable pointer shows angle at which propeller is set to help mechanic time plane engine

Heavily chromium-plated, the cap cannot be lost or pried off once it is fastened permanently. A screwdriver is the only tool needed for installing the lock since there is no drilling, cutting or alteration of the car. If water freezes in the lock, it is defrosted by holding the button down a couple of minutes. The lock works with an electric hammer action, and you can hear it "strike" when it opens.

Plane Engine Timer Shows the Angle of Propeller

For convenience of mechanics in timing airplane engines, a simple instrument has been developed that fits on the propeller hub. It has a disk marked off in degrees and an adjustable pointer to show the angle at which the propeller is set. To time the engine properly, settings are made to coincide with the degree markings on the disk as indicated by the pointer.

Paddle-Wheel Boat Propelled by Foot or Hand

Going back to the old days of river side-wheelers for his idea, an inventor has devised a paddle-wheel "rowboat" that is propelled by foot. Pedals in the bottom of the craft turn two wheels equipped with broad paddles and attached to a single crankshaft. Two long arms with hand grips extend upward from the pedal shaft so the boat may be operated by hand as well as by foot, or by both hands and feet. Steering is accomplished with a rudder turned by a rope strung along the gunwales close by the operator. It is claimed that the craft can be driven up to five miles an hour with much less effort than would be required in pulling oars.



Paddle wheel churning water, right, top, to drive foot-operated boat without use of oars. Bottom, close-up of mechanism shows mounting of pedals, handles and crankshaft

Fast Climbing Interceptor Plane Has 36,200-Foot 'Ceiling'



Interceptor plane that can climb nearly a mile a minute and has 36,200-foot ceiling. Its top speed is more than 300 miles an hour

Invading bombers will confront a stiffer challenge from the new Curtiss-Wright interceptor airplane that climbs swiftly to meet an attack. Designed for a foreign government, the ship has proved its ability to climb higher than 5,000 feet in one minute. Its top speed is over 300 miles an hour and its ceiling 36,200 feet.

Electric power consumed in the United States reached 107 billion kilowatt-hours in 1939.

2. Second Road. Holt
Arlington, Va.



Dust storm leaves farm machinery buried (above). Constructing a rock gutter (left) to halt soil erosion

Co Co

out to sea from American farms at the rate of three billion tons a year. Every muddied stream fairly shouts of good earth being carried to sea. Millions of acres of once fertile farm land are buried under the waters south of New Orleans, west of Portland and San Francisco, east of Wilmington and Charleston. Tons of it are dredged up every day to keep our rivers and harbors clear.

On May 11, 1934, our greatest dust storm ripped topsoil from the plains to the depth of the plow, sent it billowing into the sky. Aviators tried to ride above the gritty cloud, but it reached to the stratosphere. Carried eastward, it hung above Washington and New

York, blotting out the sun. It settled on ships 200 miles at sea. H. H. Bennett, chief of the Soil Conservation Service, estimates that this one storm moved 300 million tons of soil—enough to cover two million acres to the depth of an inch.

That was only one blow. Farms in Dakota and Oklahoma have been buried literally to a depth of five and six feet. Other farms have been scoured clean, two and

HOW deep is a farm? Legally a quarter section is a vast inverted pyramid, its apex at the center of the earth, 4,000 miles from the surface. Actually a farm of virgin land is from six to eighteen inches deep. Skin off that film of topsoil, and you have real estate left—but no farm. Nothing will grow anywhere in that 4,000-mile wedge, except in those few inches of topsoil.

And that fertile topsoil is being carried

Spartanburg County **Goes To SEA**

1578.



three feet of soil being ripped loose, leaving fence posts dangling in mid-air, telephone poles unearthed to their very butts.

Nine million acres of fertile farm lands were ruined by those dust storms, eighty million other acres were severely damaged; a total of 233 million acres affected—an area the size of the state of Indiana. Forty thousand families, their farms ruined,



Top, strip rotation of cotton and small grain is one means of combatting erosion. Center, pointing to original ground level on telephone pole, indicating a loss of two and one-half feet of earth. Bottom, device used for measuring loss of soil caused by water erosion

Missouri

CCC men from Camp
N. P. 8, Rocklyn, Va.

Carriozs N. near
Providence Cave



Top, graphic illustration of man's helplessness against a dust storm. Left, working on sloping of a creek's bank. Below, example of advanced state of erosion. Bottom, machinery aids in the battle to save the good earth

Rock Creek Path

moved out of the dust bowl between 1930 and 1937.

The ravages of wind were dramatic. But water erosion, insidious and undramatic, is really much more serious. Wind erosion has gravely affected four and seven-tenths per cent of the tillable land in the United

States, moderately affected twelve per cent more. Sheet erosion and gullying, both the work of water, have removed from one-fourth to three-fourths of the topsoil on forty-four per cent of all farm lands; six per cent being rendered unfit for further cultivation.

Millions of acres in the Piedmont area, stretching from Virginia to Georgia, have been ravaged. For the hills have been plowed up and down the slopes, planted to open-row crops—tobacco, corn, cotton, potatoes—year after year. Water has raced down these furrows, carrying the soil with it until the rivers run red. The furrows have become gullies. The gullies have grown with each rain—deepening ten feet in a single storm—to cut up bare fields, undermine roads, swallow homes.

There is Providence Cave near Lumpkin, Georgia. As late as 1890 this enormous gully was fertile farm land. Men are still living who attended a schoolhouse that stood on the side of a gently sloping hill. If that schoolhouse were in the same place today, it would be suspended 200 feet in the air,

K 78

K 406

over almost the direct center of this chasm.

Uncle Sam is going after those gullies now. He's going after sheet erosion, too, and dust storms. The Soil Conservation Service is educating the farmers on how to tie down their land. The Civilian Conservation Corps boys and Works Progress Administration workers have been called in emergency situations; but mostly it's a case of showing the farmers how and leaving it up to them. For with 1,200,000,000 acres more or less on the move, the job is too big to do it any other way.

It is running water, of course, that erodes land; so the job of soil conservation is to slow that water down to a walk, to make it deposit its load of silt, to make it sink into the ground and remain there.

To make the water do these things it is often necessary to redesign a whole farm—sometimes a whole countryside. Conservation Service engineers map the area to be treated, usually by aerial photography. Then an effort is made to get as much of the land as possible under cover of vegetation for as long a time as possible.

Fields too steep to stay put under cultivation are retired to forest, or are terraced. Pasture land is reseeded with Dallas grass, clover, or Lespedeza, to give a thicker sod, and hillside pastures are striped with contour furrows to check and hold the water.

The conventional square fields, which encouraged plowing up and down the slopes, are being redesigned to conform to the hillsides, all cultivation being done on contours. Dams and other mechanical structures are used only when natural methods cannot fill the bill. Farmers are agreeing to a five-year rotation of crops on cultivated hillsides; a typical rotation in the south being cotton, corn, oats, and Lespedeza, the latter remaining on the field two years.

With this form of rotation the field is divided into five roughly equal strips laid out on the contour, the Lespedeza alternating with the open rows of corn and cotton, to catch and hold what soil is carried off the bare rows. Vetch and winter peas are planted in the corn and cotton strips after harvest, to furnish winter cover and build the soil.

Large gullies are treated by digging diversion ditches to throw run-off around the head of the old channels. The edges of the gully are then sloped evenly and plant-

(Continued to page 133A)

JULY, 1940

Cardboard Chair and Table Fold Flat for Easy Storing



Folding chair and typewriter desk can be carried by one person, and are serviceable for ordinary use

Furniture made entirely of cardboard is strong and durable enough for at least temporary use in the home and office. An office chair and table, for instance, will support the typist and typewriter. You can fold the pieces into a small, flat bundle for convenience in carrying or stowing, and there is also an all-cardboard carrying case.

Ⓢ The record year for new automobiles was 1929, when 3,880,206 were registered—and forty-four per cent of them are estimated to be in operation yet.

Automotive industry

7/1/40

Johnston, 113 W. 42nd St. New York

Balloon Lifts Antenna of Mobile Radio Station



Radiotelephone operator, at left, talks with boats at sea or land stations from trailer. Right, balloon to hoist field antenna is filled with hydrogen gas from storage tanks carried in trailer

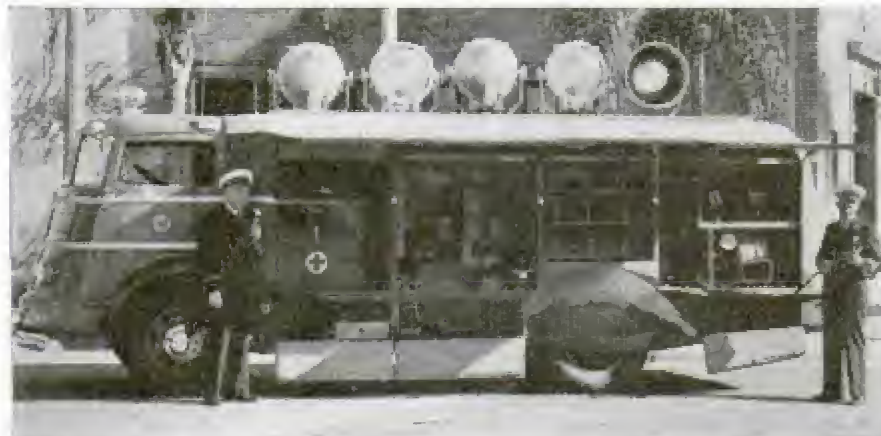
Stringing up the antenna is easy for operators of the mobile radio station used by the California state highway patrol. They simply attach the wire to a balloon filled with hydrogen gas and fly it like a kite,

providing an efficient vertical antenna. Housed in an all-metal trailer, the portable radiotelephone can be towed speedily over highways to any point, for emergency or experimental use.

Fire Department Rescue Truck Carries Field Radio Unit

With the completion of a fire truck equipped for every emergency, rescue work is now the foremost function of a

special squad of the Pasadena, Calif., fire department. Responding to all regular fire alarms, the new truck carries to the scene



Rescue truck contains equipment for any emergency, with battery of flood lights, portable lights and two-way radio to aid in fighting fires

148 separate pieces of equipment to help those in distress. Included are a first-aid kit, stretchers, respirators and heating pads, besides tools such as high-voltage tongs and gloves, bolt and wire cutters, saws, axes, pike pole and hydraulic jack. Also there is a two-way radio, directional public-address system with a microphone that can be used fifty feet from the truck, four 750-

watt floodlights, one 750-watt spotlight, and two 200-watt portable lights attached to 300 feet of cable. Two lighting plants delivering two and one-half kilowatts each provide the electricity. In addition to its rescue duties, the truck, which was designed and assembled by members of the fire-department shop, is used as a communication and contact center for relaying orders.

"Plug-In" Fountain Humidifies Air in the Room

Double duty is performed by an electric fountain that adds a touch of beauty to the home while helping to air condition the room. You merely plug it into a wall outlet, no pipe connections being needed since the fountain reservoir holds the water supply. As much as a pint is evaporated in twenty-four hours. A few drops of perfume or pine essence added to the water quickly fills the room with fragrance. Made of spun aluminum, the fountain is available in five colors.



Just plug cord in socket to start electric fountain

JULY, 1940

Grotesque "Crown" and Headgear Give Electric Beauty Treatments



Woman wearing crown of hair clamps, at top, exhibits fingertip guards which protect nail polish. Below, electric mask for facial treatment

Grotesque headgear and metal guards for the fingertips are among the latest scientific tools of the beauty specialist. Introduced at a recent trade show of beauty-parlor operators were an electric mask for facial treatment and an electric helmet for the scalp. One woman demonstrated a "crown" of clamps for permanent waves and the fingertip guards, which are intended to shield freshly polished nails.

Twins are born once in every ninety-three births, but the chance of triplet births is only one in 8,649, and quadruplets occur but once in 1,339,975 births.

Science Service
April 1940

Transparent FURNITURE



The room above, at left, exhibits Plexiglas in a variety of uses—vanity, lamps, table and chairs; right, an interesting lamp designed from plastic rods, and a decorative table. Graceful chair back, lamp and bed, at left, are of Plexiglas; the young lady demonstrates how easy it is to clean. Below, the pup's bed, shaped from plastic sheets and rods



People who live in Plexiglas houses could throw stones with some degree of safety, for Plexiglas—as sparkling as crystal and as fragile in appearance as glass—actually is a sturdy and nonshattering material. Furniture made of this acrylic resin plastic is rapidly gaining popularity in modern homes, for it readily lends itself to fabrication. Although four to six times as costly as glass, it is more durable; more sanitary and durable than wood, too, Plexiglas furniture will not warp, is easier to clean, moistureproof and gives the room a sparkle. On the other hand, it can be marred by a lighted cigarette



Rohm + Haas Co. Inc. Designed by Katherine
 222 Washington St. New York, N. Y.

of PLASTICS



Not only is Plexiglas furniture on the market, but home workshop enthusiasts are finding they can work the material themselves. In fact it has some advantages over wood and compositions, for, coming in sheets and rods, it can be bent and curved to any shape after being heated in the kitchen oven to 220 degrees Fahrenheit. More susceptible to handling than glass, it can be sawed, carved, drilled, sandpapered, sandblasted and turned on a lathe. It cannot, however, be nailed, for Plexiglas will split



At top, left, legs of two chairs, the tables and lamp base are of transparent plastic; right, a two-piece smoking stand. Supported by a sheet of Plexiglas bent at 220 degrees Fahrenheit is a table top cut from another sheet. Legs of plastic ladder for the library, above, were turned on a lathe, the steps were cut from plastic sheets. Except for the lampshade, chains and wire, the table and lamp at right are entirely of plastic. Plexiglas is lighter than glass, warm to the touch and permits passage of ninety-two per cent of light rays

Plexiglas Furniture - Springfield, Mass. - 228 E. 47th St. - New York City

Pedal Tees Up Golf Balls for Practice Swing



Seventy swings without a single bend to tee up the ball are provided by an automatic tee for practice golf. The player steps on a pedal, and up pops a ball on the tee.

Diet of Dried Grass for Man Is Rich in Vitamins

Right in your front yard are all the vitamins you need. Twelve pounds of grass, dried, contain more vitamins than 340 pounds of fruits and vegetables, which is more than the average person consumes in a year. But green grass isn't palatable, and sun-dried grass has lost much of its vitamin content. Now scientists believe they have found a way to add grass to man's diet. Quick-dried at high temperature, then powdered, it was proved fit for human food and when sealed in nitrogen-filled containers its vitamin content was unimpaired after a two-year test.

A step on the pedal tees up a golf ball for practice swing. The balls are fed from a spiral channel in the bucket, which holds seventy

"Baby" Battery-Service Truck Advertises Repair Shop

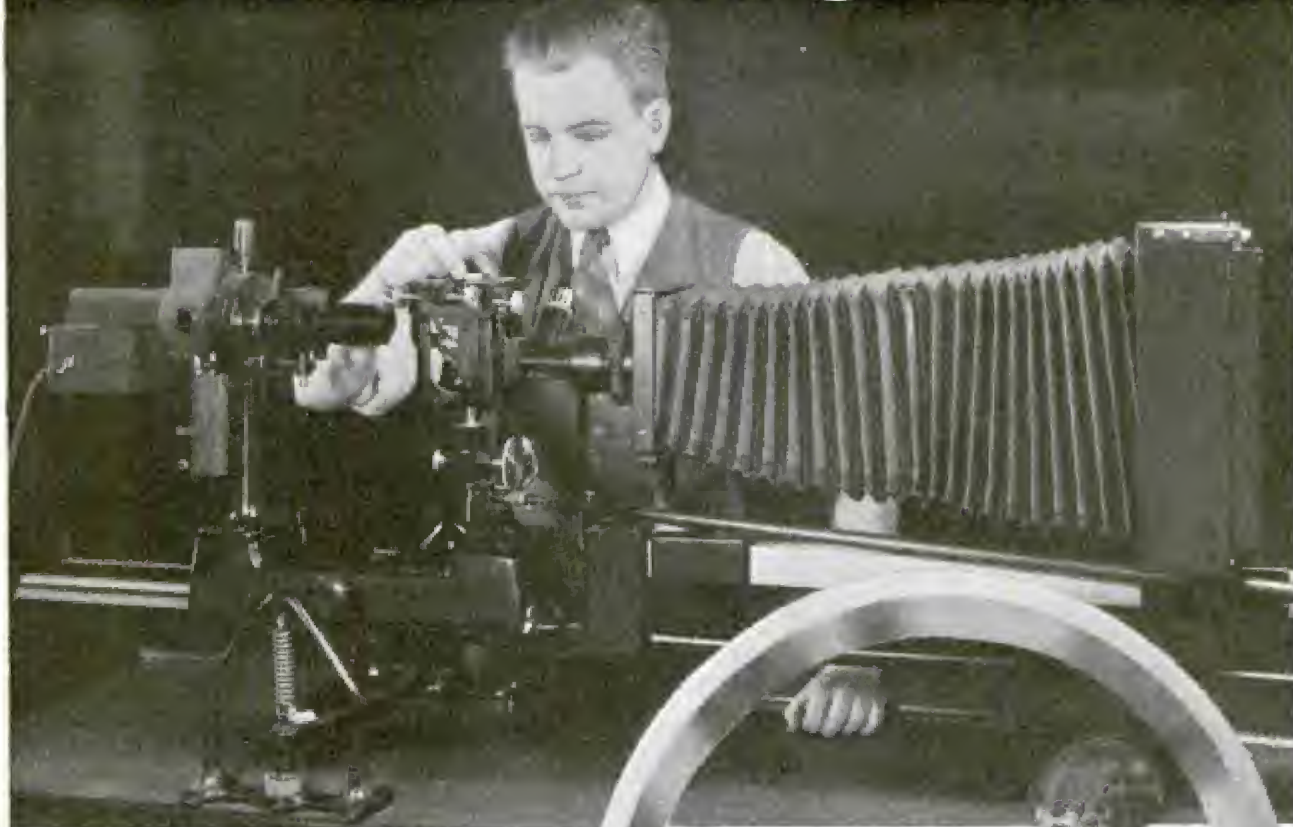
Using the chassis and body of a midget car, the owner of an automobile repair shop built a miniature wrecker for running errands and, incidentally, to advertise his business. As a repair truck it is handy for tire and battery service, carrying a tank of "free air" at the rear, but its towing ability is limited to miniature cars. A section of the body behind the door was removed to make room for the crane.



Miniature car converted into handy service truck, at right in picture, advertises repair shop and performs small jobs

Organic chemists throughout the world made about 25,000 new chemical compounds during 1939, six per cent more than in 1938.

FRICION FIGHTERS



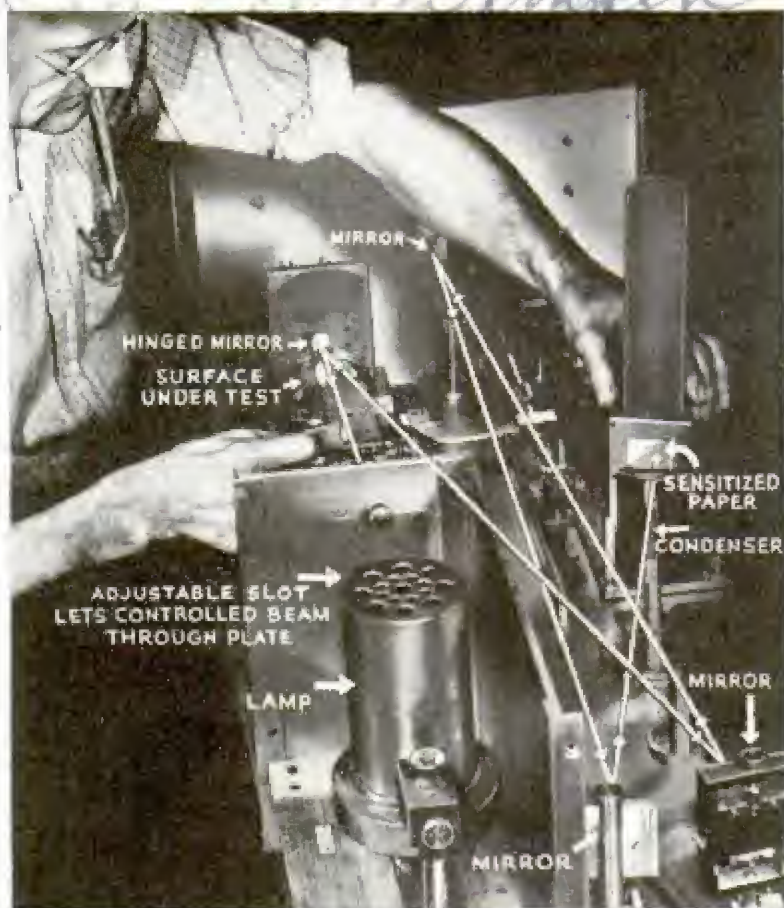
MORE than 700,000 miles have rolled beneath the wheels of a big locomotive operating in the Pacific northwest and, despite the terrific punishment of heavy equipment, continuous high speeds and torturous thrust on curves, its bearings are still in excellent condition.

That locomotive was the first to be fitted completely with roller bearings—science's answer to the problem of offsetting friction in heavy equipment. Built for the Timken Roller Bearing company at a cost of \$180,000, the locomotive was given a test run of more than 200,000 miles by fourteen railroads and then torn down. Microscopic examination of the cone, rollers and the cup failed to reveal defects, so the engine was put back together and placed in regular service on the Northern Pacific without reconditioning or change in the original bearings.

Everyone is familiar with the ball bearing, which is employed in one of its commoner uses to make roller skates run smoothly. The ball bearing is the oldest of the friction-combatting family, and for more than a



Top, testing bearings with aid of photography. Bottom, sitting on four-ton Timken bearing, the young lady holds another bearing weighing only a few ounces



ings is in a small air-driven grinder where a speed of 100,000 revolutions per minute is standard. When the shaft turns that fast the balls rotate on their own axes at four to five times that speed, which interpreted in rotations per second would be approximately 7,000 turns per second. Higher speeds than this have been attained by ball bearings, but mostly in laboratory equipment where continuous operation was not required.

Different from the ball bearing, which is simply a steel ball running or turning in its own track, the roller bearing is cylindrical, either straight or tapered. Its ability to withstand tremendous loads and stresses springs from the fact that it offers an unusually large bearing surface and that its roller action offsets development of friction.

It was forty-two years ago that a carriage manufacturer conceived the idea of applying tapered roller bearings to wagon wheels. "One horse," he advertised, "can do the work of two if you use roller-bearing axles." In the budding automobile industry roller bearings found a ready market. Engines were not too powerful and starting from a dead stop was a serious problem. It soon was dis-

quarter century its parts have been made to such a close limit of accuracy by such companies as Norma-Hoffmann that interchangeability could be insured—the forerunner of standardization of manufactured parts that permitted making automobiles on a quantity production basis at low cost. One interesting use of ball bear-

ings is in a small air-driven grinder where a speed of 100,000 revolutions per minute is standard. When the shaft turns that fast the balls rotate on their own axes at four to five times that speed, which interpreted in rotations per second would be approximately 7,000 turns per second. Higher speeds than this have been attained by ball bearings, but mostly in laboratory equipment where continuous operation was not required.



Top, photo-diagram showing how graph of surface roughness is obtained, from where specimen is placed on machine by operator to the sensitized paper where graph appears. Lines and arrows indicate the operation. Bottom, left, leveling specimen on same machine. Right, illustrating how precision manufacture of ball bearings makes it possible to interchange parts without loss of efficiency

covered that lessening this starting friction with roller bearings was the answer.

From the auto industry, roller bearings went into industrial fields and today nearly all shafts and wheels in modern factories turn on these bearings. In the steel mills the massive rolls which smash huge ingots into rods and tubes operate on the largest bearings made for any purpose—three to five feet in diameter and weighing as much as four and one-half tons.

Only a few years ago every locomotive, every passenger coach and every freight car rode on friction bearings, which often developed hot boxes, "froze up" and burned out. It was not until 1926 that a commercially usable roller bearing was developed for railroad equipment. Then the first all-roller-bearing engine was built and today roller bearings are used on most new locomotives, passenger cars and streamline trains.

The giant snow cruiser which Admiral Byrd took to the South

(Continued to page 125A)



Top, sizing bearings and parts to minute tolerances in General Motors division plant. Center, examining Micarta bearings for steel mills. Bottom, left, extracting gas from steel. Right, specimen under load in test with (inset) type of stress photo obtained

Four-Man Life Preserver Contains Food and Water



Left, four persons clinging to metal life preserver in fresh water. Right, placing food and water in compartment

As many as six persons can be supported in the ocean by an all-metal life preserver that withstands long submersion without becoming water-logged, but in fresh water, which affords less buoyancy, its safe capacity is four average-size people. In a sealed compartment it carries food rations and liquids to take care of six persons for at least half a day. There is also space for storing flares and smoke signals.

Mechanical Raw Wool Sampler Replaces Inspection by Hand

Hand methods of inspecting imported raw wool to determine how much duty to assess, are to be supplanted by an electrically operated sampler and tester. Accuracy is essential because import duty, running as high as thirty-four cents a pound, is assessed on what is termed "clean content" of the bale, meaning clean wool fiber minus grease, dirt, burs, sand and other foreign ingredients. The new mech-

anism, devised by United States Treasury Department chemists, cuts out a sample of wool with a steel tube fitted with razor blades that quickly penetrate the bale. The sample is then submitted to a laboratory test in the machine, including dry cleaning by solvents to remove most of the impurities, then scouring, rinsing, drying and conditioning. The weight of the "pure" wool is then used as a basis for estimating the amount of clean content of the entire bale. The entire operation is performed accurately by the sampler in only twenty seconds.

Suction Cup Anchors Hose for Washing Prints in Sink

Any sink or wash basin can be converted into an efficient tank for washing photo prints or negatives



Hose anchored by vacuum cup directs whirlpool of water over prints while drain regulates water level

by using a twin-unit drain and hose now on the market. The drain itself keeps the water at the desired level, and three tiny rubber "fingers" prevent the prints from clogging where the water is drawn off. A three-foot rubber hose attached to the faucet is anchored to the basin by a vacuum cup, directing the flow of water to form a continuous whirlpool keeping the prints apart and in motion.

Harness Holds Flashlight Leaving Hands Free

To keep a flashlight focused on your work and still leave both hands free, there is an adjustable holder that straps about the shoulders. The light beam may be turned in all directions, up, down or sidewise, and can be made to stay in any position selected by tightening a single buckle. Handy particularly for mechanics, servicemen, truck drivers and meter readers, the holder is easy to put on or take off.



Flashlight in shoulder strap is adjusted quickly to throw beam in any direction

JULY, 1940

Injured Sailor in a Safety Jacket Is Hoisted Ashore Easily



Civil Defense Volunteers, on life-saving duty off British coasts, put ashore a wounded seaman bound in a belted jacket

Belted fast in a safety jacket to prevent any injury, a wounded sailor is hoisted to shore from a British trawler. It is part of the duties of the Civil Defense Volunteers, working along the English coasts, to go to the aid of trawlers attacked by enemy aircraft and to bring home any wounded men.

Fast Working Pressure Cooker Saves Fuel

Food cooks about four times as fast in a pressure saucepan just put on the market, and fuel saving is estimated at seventy-five per cent. Peas, and asparagus are done in one minute, cauliflower and beans in two minutes, roast chicken in twenty minutes. The cooker has a tight lid without complicated locking mechanism.



National Pressure Cooker Co. Eau Claire, Wis.

K 829.

Torpedo Boats Fight Back with Multiple Guns



Speedy motor torpedo boats of Britain's "mosquito patrol" carry a triple threat against enemy attackers coming by sea or air. Looking skyward from the bridge, a brace of multiple anti-aircraft machine guns has been added to the diminutive fighting ships to challenge bombers and air raiders preying on sea-borne shipping and coast defenses. Other arms include the usual torpedo tubes for use against surface craft as well as submarines within range, and depth charges to deal with submarines lurking below the surface. A large fleet of these well-armed racing boats has been completed for coastal duty.

Above, multiple anti-aircraft guns aimed at enemy aircraft from "nests" on deck of Britain's new high-speed torpedo boats, at right, which also carry torpedoes and depth charges



'Town and Country Wagon' Is Made by Rebuilding Auto

To create a vehicle which would serve the purpose of a "town and country wagon," and at the same time retain the

streamline contour of the passenger car, Brooks Stevens, an industrial designer of Milwaukee, Wis., rebuilt the body of a 1937



Roomy compartment at rear of rebuilt auto carries luggage

Packard. Everything from the center doorpost back was torn out, leaving only the rear seat, which was made removable. The boxlike appearance of conventional station wagons was avoided by following the lines of modern-car styling in reconstructing the rear section of the body, which was built of birch and redwood paneling coated heavily with varnish. Another feature not found in the manufactured vehicle is the one-piece, all-metal top, insulated and upholstered inside with leather. With the rear seat removed, the finished car has as great carrying capacity as a station wagon.



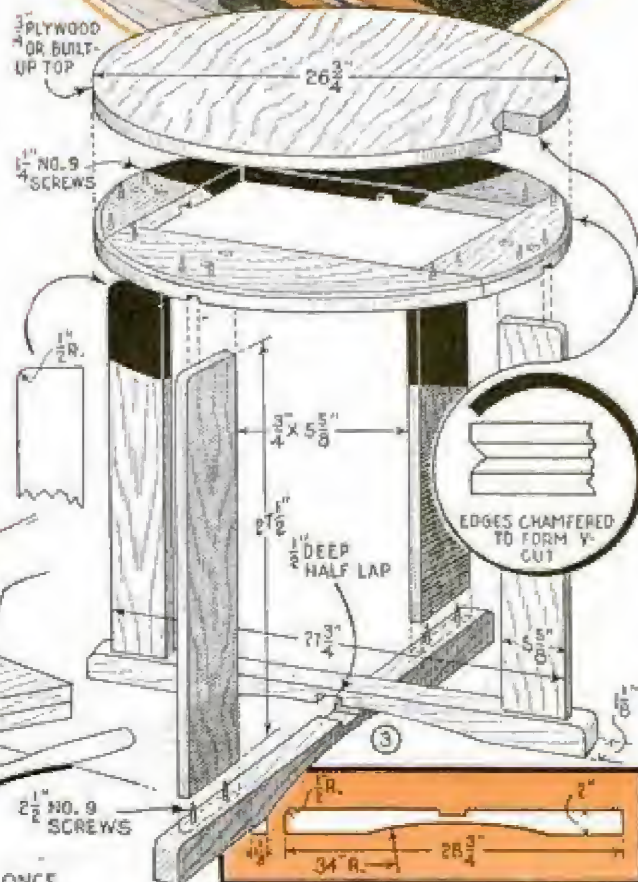
CRAFTSMAN

DEN or COTTAGE TABLE

built with few hand tools

By GEORGE E. BASICH

SIMPLICITY of this smartly styled occasional table, Fig. 1, makes it particularly appealing to the craftsman who works with hand tools. Starting with the double-thickness top, it is necessary first to glue up edgewise several narrow lengths of stock to make up the required width from which to cut the circular top. Where the exposed edges of plywood can be covered as in the case of a painted finish, you can simplify the job by using a $\frac{3}{4}$ -in., 5-ply panel for this piece. Four battens, $5\frac{1}{2}$ in. wide, which are temporarily fastened to the top so that both thicknesses can be cut at one time, are screwed to the underside, butting the ends of the pieces in the manner shown in Fig. 2. Number each batten and place a corresponding mark on the top piece to identify each when later re-assembling. Mark a $26\frac{3}{4}$ -in. circle on the battens and with a compass saw cut through both pieces, saw-

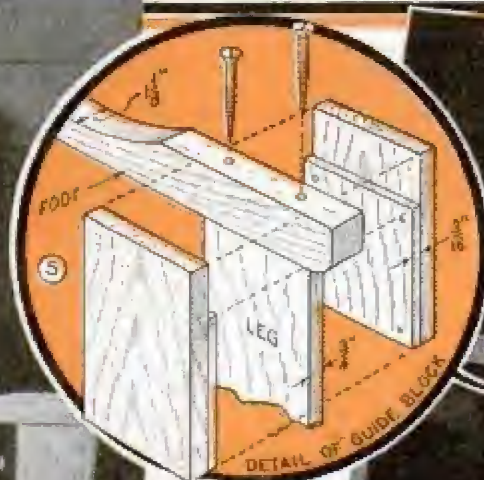


MATERIAL LIST

- 4 pcs. $\frac{3}{4}$ by $5\frac{1}{2}$ by 28 in.—Legs
- 3 pcs. $\frac{3}{4}$ by 9 by 27 in.—Top
- 4 pcs. $\frac{3}{4}$ by $5\frac{1}{2}$ by 20 in.—Battens
- 2 pcs. $1\frac{1}{2}$ by 2 by $28\frac{3}{4}$ in.—Base



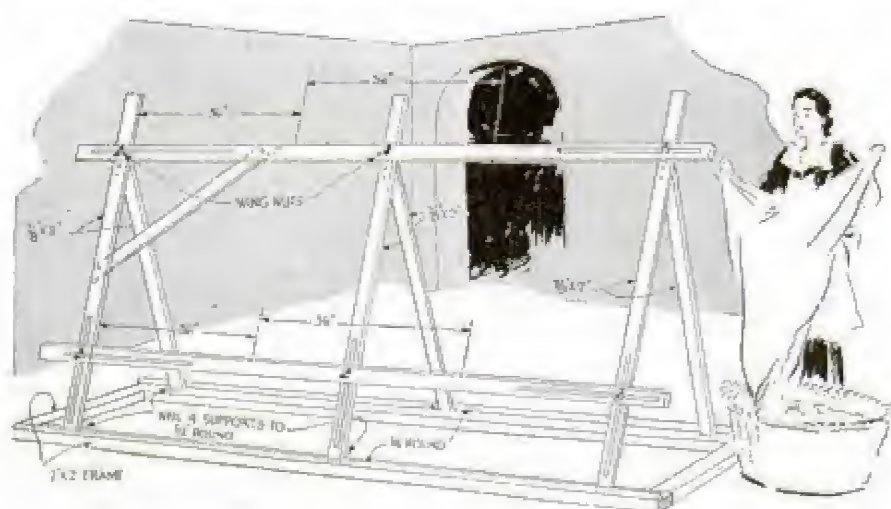
CUTTING BOTH TOP AND BATTENS AT ONCE



ing slightly to the right of the line to allow for finishing the edge smooth with a plane and sandpaper. When this is done remove the battens and plane a slight chamfer around the lower edge of the top and the top edge of the battens as shown in the circular detail in Fig. 3. Grooves, to receive the "board" legs snugly, are cut equidistantly apart $\frac{3}{8}$ in. deep, after which the battens are attached to the top of the legs with $2\frac{1}{2}$ -in. screws. The battens can now be fastened permanently to the circular top with glue and $1\frac{1}{4}$ -in. f.h. wood screws.

The cross members of the base, which fit flush at the center in a half-lap joint, are cut of $1\frac{1}{8}$ -in. stock following the dimensions given in Fig. 3. Centering the legs accurately on the base so that an equal space will be had on each side, is accomplished easily by making the jig shown in Fig. 5. This consists of two scrap pieces of wood fitted with $\frac{3}{16}$ -in. blocks which in turn are placed on each side of the leg to hook over the edge of the base. C-clamps are used to clamp the work firmly to both leg and crosspiece while driving the screws down into the end of the leg. Check each pair of legs to see that they are spaced equally apart at both top and bottom, Fig. 4. Go over the entire table and sand it smoothly in preparation for finishing with stain or enamel, using a finish most suited to the kind of wood.

Taking the 'Sting' and Error Out of Your Curtain Stretcher



As this stretcher is left standing, you will have none of the stings that result from setting it up and taking it down. It also simplifies getting right-angle and parallel adjustments. A leg is attached with a T-hinge to each vertical rail. One end rail is locked at right angles to the top rail with a brace nailed to both. This end rail and leg are nailed to the base as are the cen-

ter rail and leg. The other end rail is movable toward the center, and the bottom rail slides up or down. In use, you measure across both ends of two parallel rails, from the pins. Keep measurements of curtains in a notebook hanging on the stretcher.

Improving Your Fishing Snap

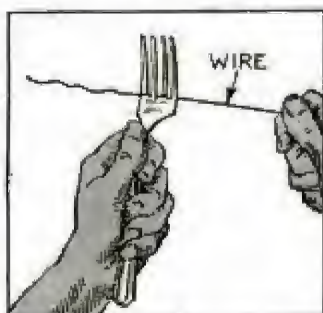


Have you ever lost a good fish because the hook snap unfastened? I have, and was able to avoid the trouble by altering the snap. To do this, the end of the snap is bent up slightly to slip into a small hole filed in the catch as indicated. Altered in this way, the snap is not likely to be sprung open by a jerk or hard pull on the hook.

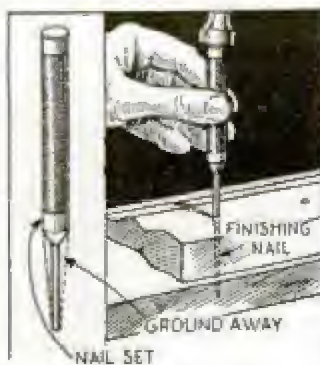
—Robert Page Lincoln, Hot Springs, Ark.

Discarded Table Fork Straightens Small-Gauge Wire

A radio repairman, who works with odds and ends of small wire, has found a discarded table fork a convenient tool for removing kinks and bends from this material. The wire is passed in and out through the tines and then pulled to draw and straighten it.



Nail Set Used to Remove Molding



Ground down so that its small end is slender, a nail set can be used in removing molding, trim, etc., with minimum risk of damaging the wood. Simply use the nail set to drive the finishing nail right through the wood instead of prying the wood off and removing the nails in the conventional way.

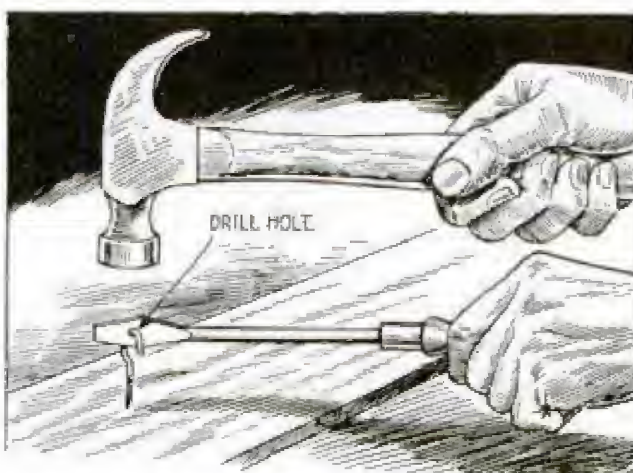
Paper Clamps on Your T-Square Space Ruled Lines



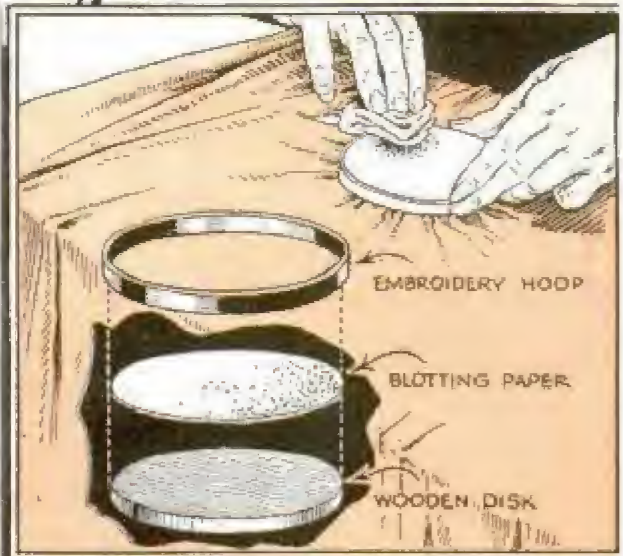
When drawing a number of equally spaced lines of uniform length, put a couple of paper clamps over the blade of a T-square. The top edges of the clamps are set to space the lines, while the inside edges serve as stops for the pencil.

Easy Way to Drive Screw Hooks

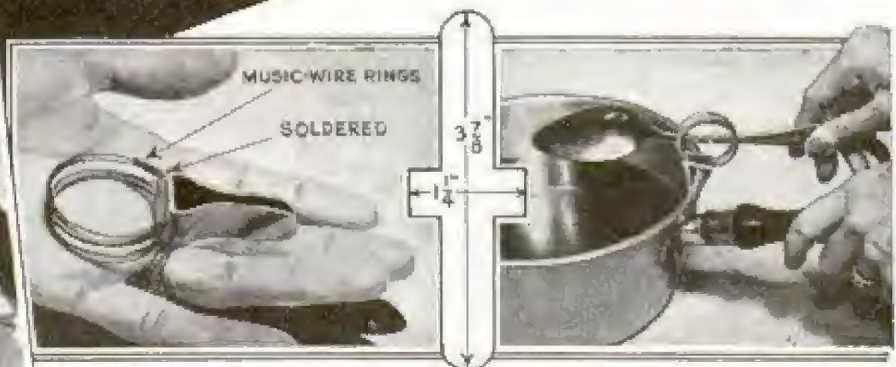
To hold screw hooks for starting and driving, drill a hole through the blade of your screwdriver and use it as shown. A tap with a hammer will sink the end of the screw into the wood so that the threads will grip it. Then the screwdriver can be raised to a vertical position and turned to drive the hook.



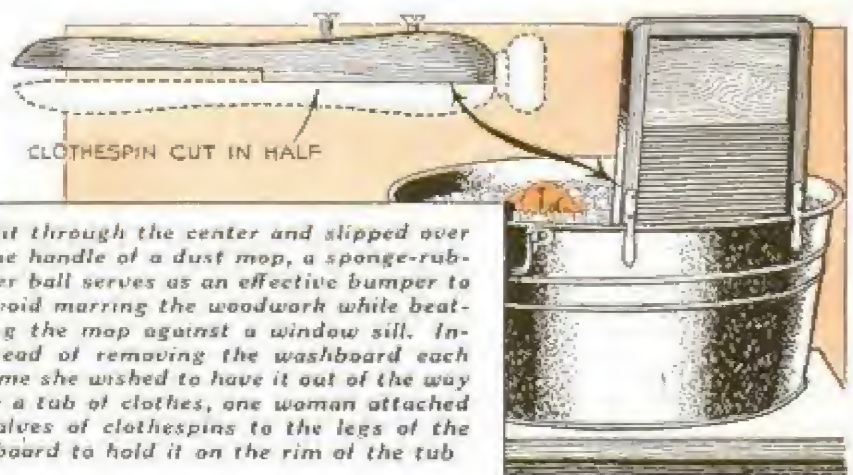
Solving HOME



A clothes hamper is out of sight and easy to get at if you keep it on a shelf attached to the inside surface of a closet door as at the left. Keeping a portion of a garment stretched while removing a spot is a simple matter if you use a wooden disk and an embroidery hoop as above. It is best to place a disk of blotting paper on top of the wood

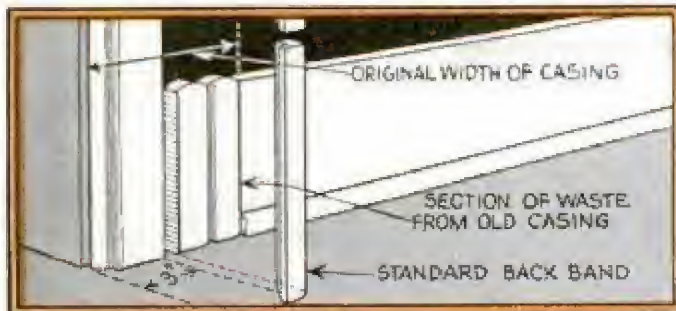


Left, the pull chain of a bed lamp will not mar the bed if a slip-on eraser is put on the chain end. The holder above is ideal to keep a spoon on a pan. It consists of two or three coils of spring wire and a piece of sheet brass cut as shown. The tabs at the sides of the brass strip are folded over the coiled wire to hold it

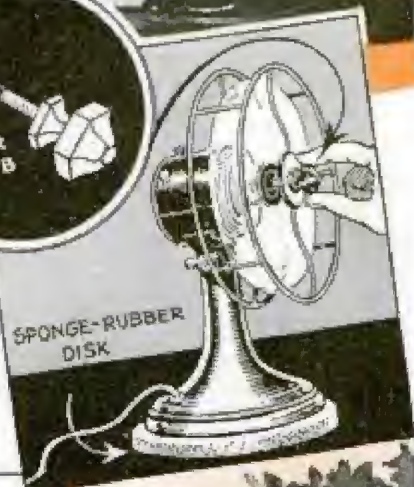
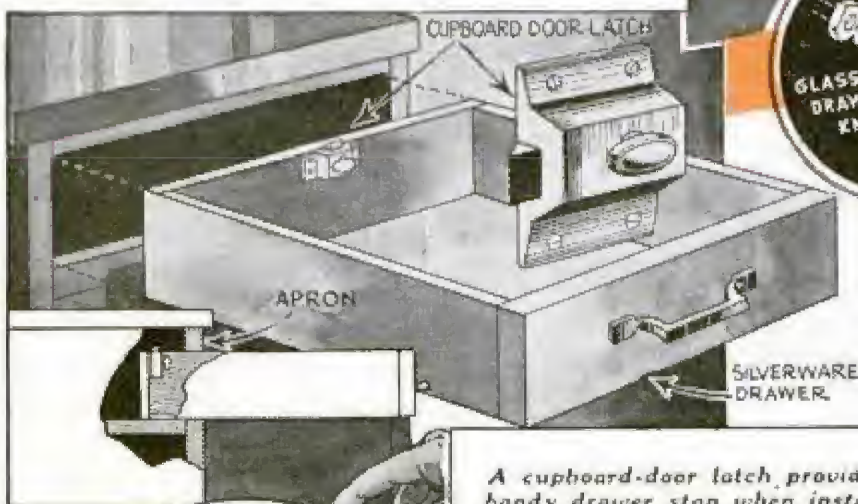


Slit through the center and slipped over the handle of a dust mop, a sponge-rubber ball serves as an effective bumper to avoid marring the woodwork while beating the mop against a window sill. Instead of removing the washboard each time she wished to have it out of the way in a tub of clothes, one woman attached halves of clothespins to the legs of the board to hold it on the rim of the tub

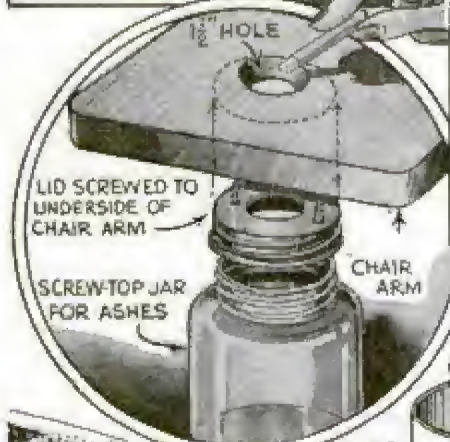
PROBLEMS



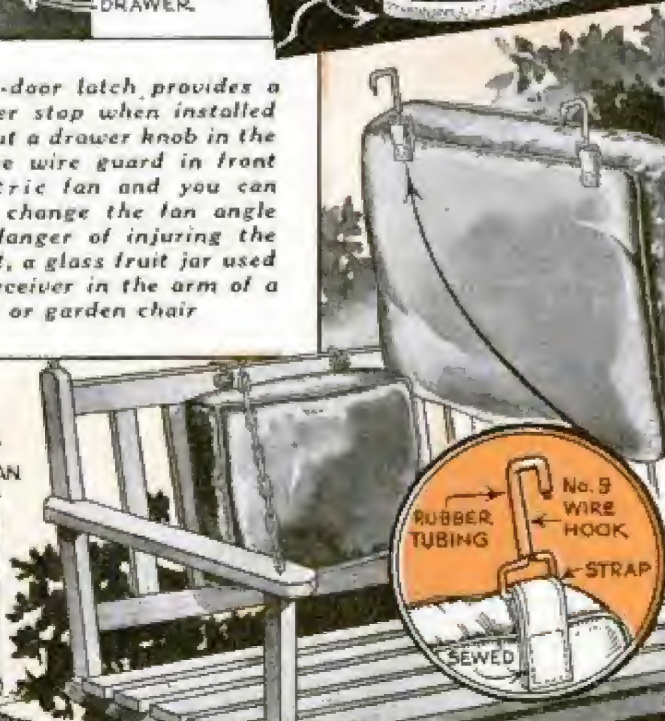
After replacing old door casings with new, narrow type having back bands, the spaces left between them and the baseboards were filled with sections cut from the molded portions of the old casings. Due to the irregular shape of these, the joints at the ends of the baseboards were not noticeable.



A cupboard-door latch provides a handy drawer stop when installed as above. Put a drawer knob in the center of the wire guard in front of an electric fan and you can grasp it to change the fan angle with little danger of injuring the fingers. Left, a glass fruit jar used as an ash receiver in the arm of a porch or garden chair.



CUT ON DOTTED LINES
1-LB. COFFEE CAN



When sprinkling near a sidewalk, a deflector made from a large can as at the left, will keep water spray from wetting anyone walking by the sprinkler. Wire hooks sewed to cushions of a porch swing as above, and slipped over the back of the latter, will keep the cushions in place. The hooks should be covered with rubber tubing to prevent marring the swing, and the straps attaching them should harmonize with the color of the cushions.

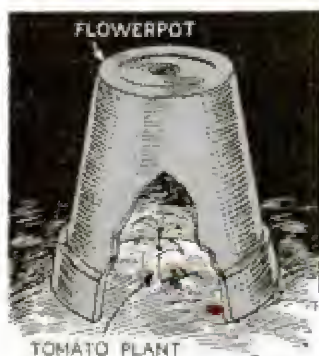
Drawing Stand Mounted on Lathe Is Adjustable to Any Angle



Here is an easily assembled drawing stand that is very useful when mounted on the lathe. It keeps the drawings neat and clean and they are always in full view of the operator. The stand is constructed from $\frac{3}{4}$ -in. pipe fittings with the short coupling in the center tightened just enough to hold the table at the desired angle. When not in use, the stand may be tilted toward the back of the lathe as shown in the upper detail, where it will be out of the way.

—Howard R. Heydorf, Missoula, Mont.

Drouth-Resistant Tomato Plants



Lester J. Francisco of Nebraska, whose hobby is crossbreeding plants, has found a definite way to make tomato plants more drouth resistant.

Four or five tomato seeds are planted in a shallow hill in the usual way, then covered with an inverted flowerpot. Watering is done daily with a teakettle through the hole in the bottom of the pot. The covering is left on until well after germination starts. The pot provides shade and conserves moisture. When the plants are an inch or so high, the pot is removed, the most vigorous plant selected and the others pulled up. The pot is then replaced until the plant is several inches high, when it is removed. This treatment tends to develop deep tap-root structures and the resulting plants grow into sturdy, heavy producers.

Hose on Teakettle Spout Steams Wood Strips

The next time you have a number of small wood strips to bend, it will take only a few minutes to steam them in a length of radiator hose placed over the spout of a teakettle. Finishing nails driven through the hose just above the spout hold a small piece of screen which prevents the strips from falling into the teakettle. It's a good idea to place a cloth over the end of the hose as indicated, when long steaming is necessary.

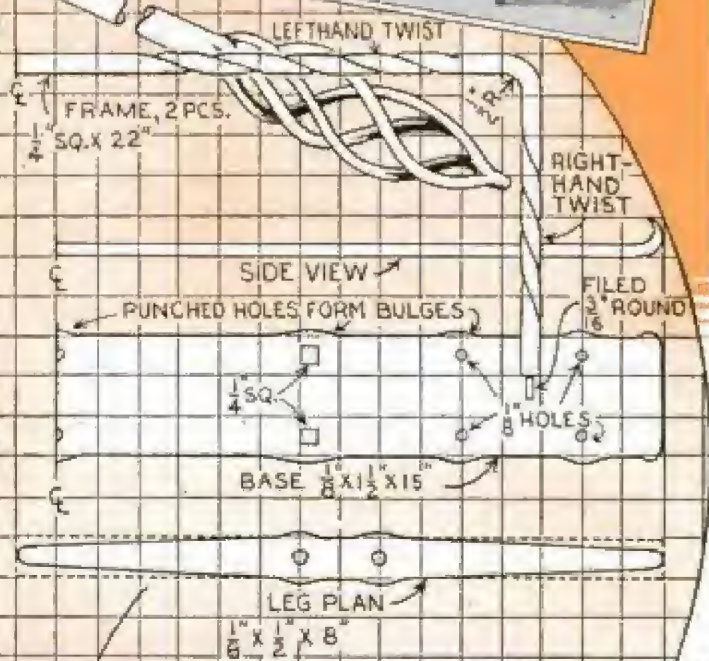
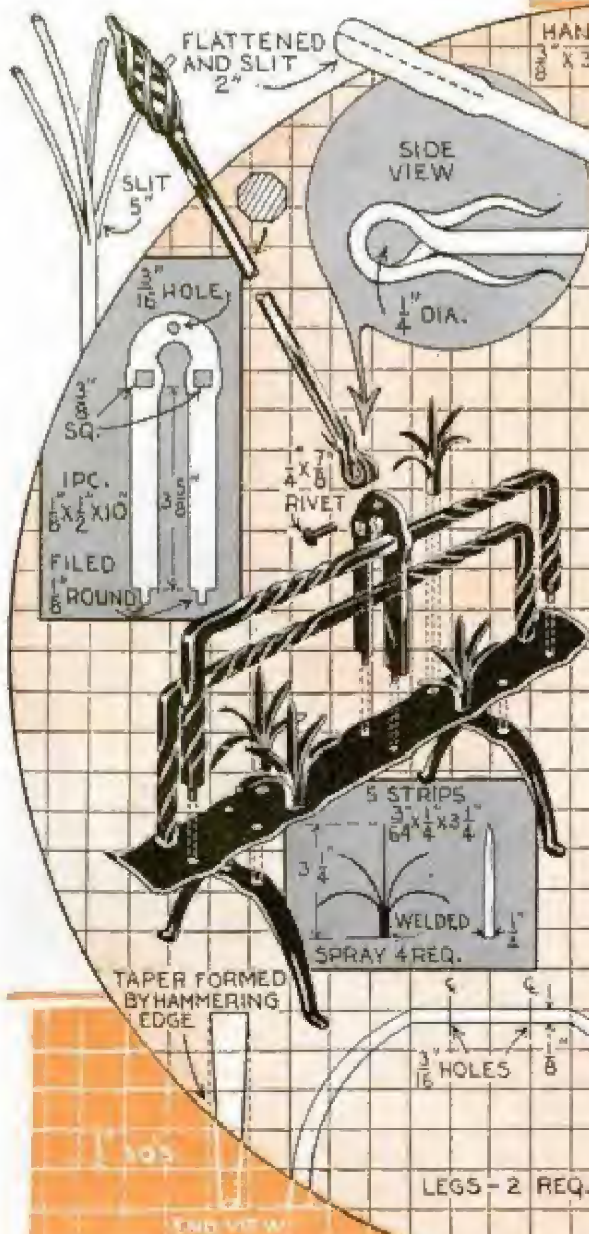
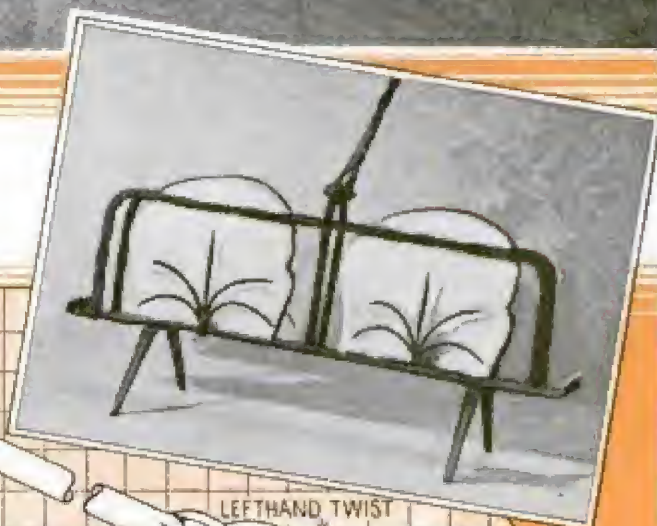
—Dale R. Van Horn, Lincoln, Neb.



Colonial FIRESIDE TOASTER

is hand wrought

Reminiscent of early days, this quaint little fireside toaster will serve as a practical and ornamental fixture for your fireplace. Full-size patterns of the parts comprising the "basket" should be made, to follow in bending the iron to shape. To form the upper end of the pivoted handle, first file the iron square, slit it into four 5-in. strips, heat and twist them together in a spiral. A nut screwed on the end is hammered into a ball, and then the spiral is "opened" by reheating and untwisting the end with a pair of pliers



Walking Stick Tipped with Hose Serves as Pusher for Coaster



To provide motive power for a coaster, when his small son accompanies him on a walk, one father employs a walking stick with a rubber-hose tip. The hose is attached permanently to the end of the cane, and the free end is drilled and slotted to slip snugly over the rear axle of the coaster. Thus the boy may steer his vehicle with apparent independence, but always under the control of his father.

Removing Lint from Garments Before Pressing Them

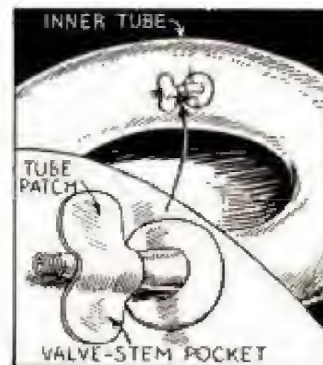


Finding that many garments came in covered with lint, one operator of a cleaning and pressing service conceived the idea of using a rubber plate scraper to remove the lint. Best results were ob-

tained by serrating the edge of the scraper. After stretching the garment over a board, the scraper is dipped in water and used like a brush to roll up the lint.

Rubber Patch Shields Valve Stem of Inner Tube for Swimmers

When an inflated inner tube is to be used for safety or sport in swimming, possible injury from the metal valve stem may be prevented by attaching a tube patch where it will provide a pocket. The stem is inserted in this pocket after inflating the tube, and the patch will not prevent the use of the tube for its original purpose.



Paper Clips Better Than Pins When Stitching Hems

Having occasion to hem a number of pieces of heavy cloth, one seamstress discovered that paper clips could be used to hold the folded cloth much easier than pins which were hard to force through the fabric. The clips are merely slipped over the edge of the folded cloth as indicated.



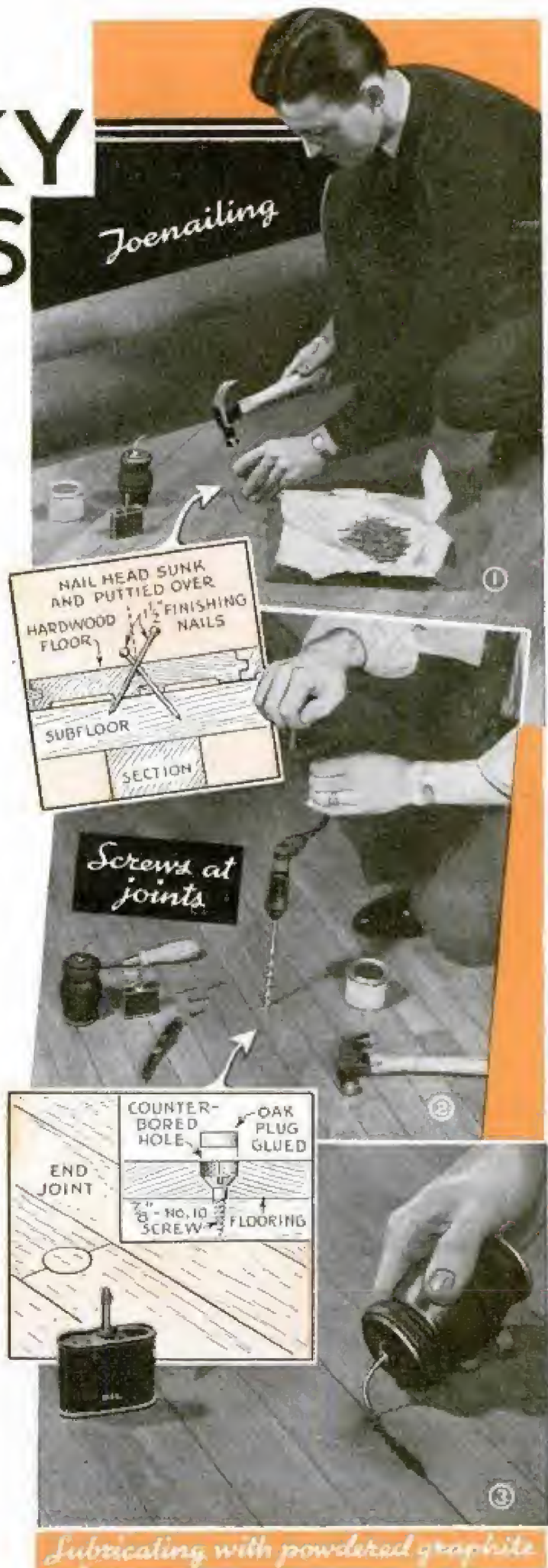
Silencing SQUEAKY FLOORS

By WAYNE C. LECKEY

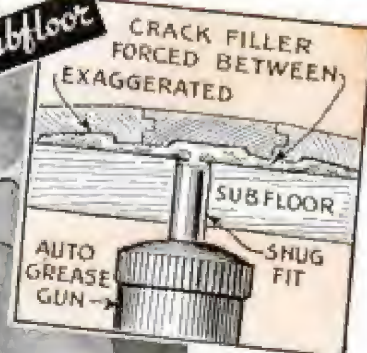
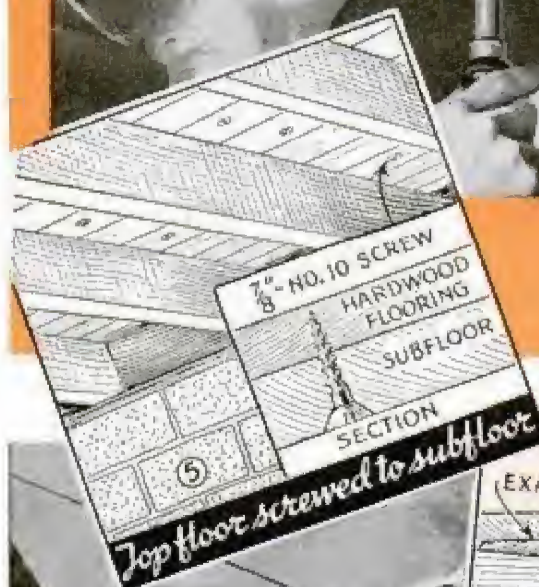
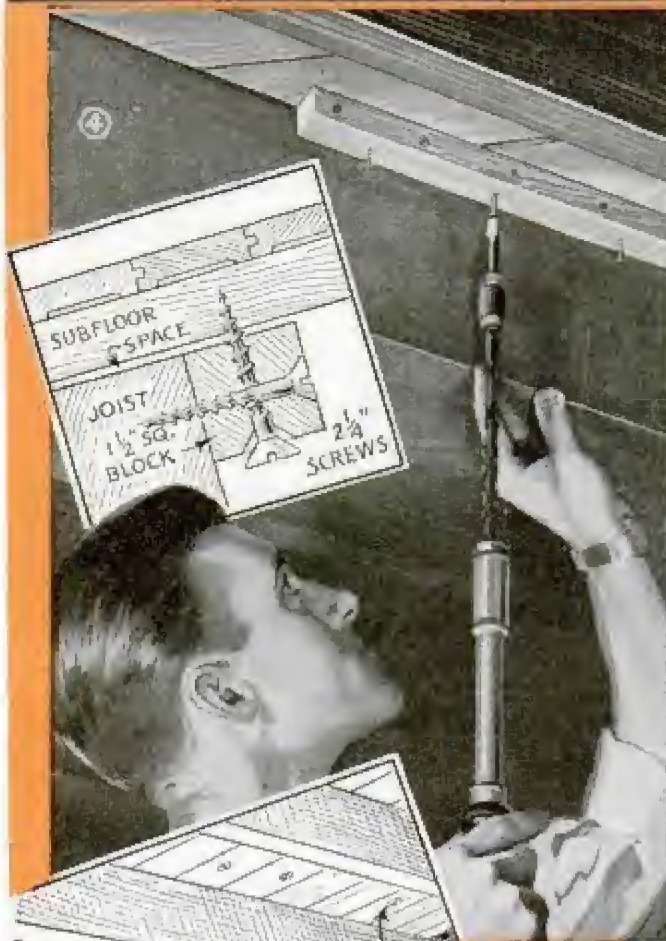
HAVE you annoying squeaks in your floors? There are several ways to cure the trouble, but as each squeak presents an individual problem, no one treatment can be given that will guarantee results in all cases. Where floors cannot be reached from below you will have to work from above as is shown in Figs. 1, 2, and 3. Squeaks in lower floors that are accessible from a basement can be stopped usually by one of the methods indicated in Figs. 4, 5 and 6. Before proceeding in any case have someone stand or walk on the spot while you carefully check the action taking place and the exact location where the squeak is most noticeable. If the joints seem to be nailed inadequately, toenailing, as in Fig. 1, will often silence the squeak by drawing down the hardwood strips securely to the subfloor. Finishing nails, 1½ in. long, are driven at a tangent along the joint, in both directions, and the heads set below the surface and filled flush with wood putty.

Where movement is detected at the butt ends of the strips, a screw straddling the joint will pull both ends down solidly as in Fig. 2. Use a ¾-in., No. 10 wood screw in a counterbored hole centered on the joint. Take care not to counterbore completely through the hardwood strip, but just enough to allow the screw head to be hidden with an oak plug, which is pared off flush and touched up with a little varnish to match the floor as closely as possible.

In the event rubbing is noticed along an open joint, penetrating oil mixed with powdered graphite has been found effective in relieving the



Drawing subfloor down to joists



⑥ Crack filler forced between floors

squeak, as it lubricates the joint. The oil is used mainly to carry the graphite down into the joint, where it will remain long after the oil has dried out. The crack can be packed with graphite before applying the oil, Fig. 3, or the two can be applied at once with an oilcan.

Sometimes a squeak is caused by a loose subfloor that has become buckled. This can be determined quickly by checking along the joists in the vicinity of the noise to see that the subfloor is in contact at all points. If not, Fig. 4 shows how a hardwood strip, first screwed solidly to the joist even with the top edge, and then fastened with screws driven up into the subfloor, will draw it down firmly. Screw holes in the block should be oversize, and be sure the screws are not too long to pierce completely through the hardwood flooring.

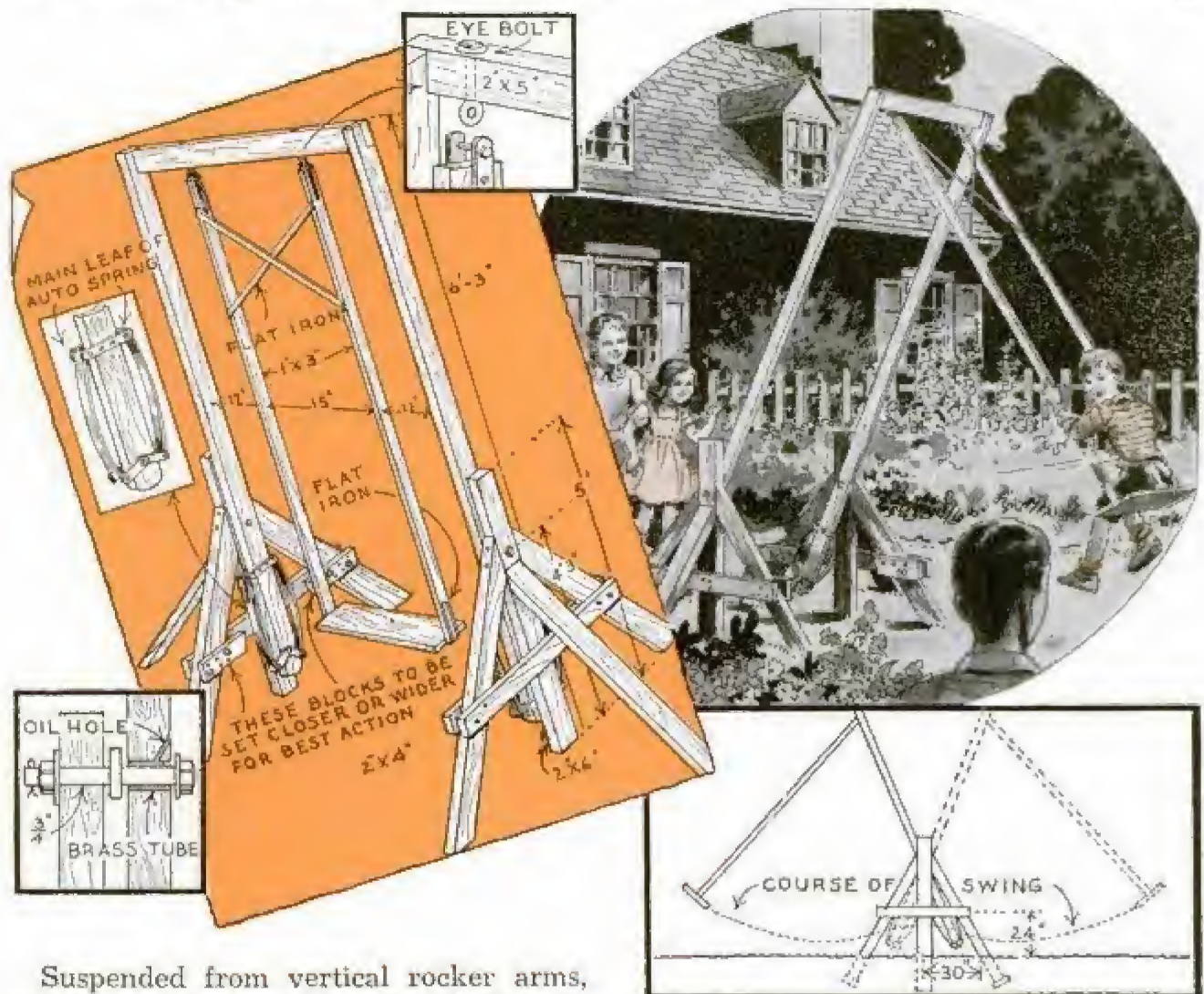
Fig. 5 illustrates a manner in which the top flooring can be anchored securely to the subfloor by driving short 7/8-in., No. 10 wood screws up from below. To bring both floors together while driving the screws, have someone stand on the spot above. This will permit the short end of the screw to take hold in the hardwood. Again it is important that you do not drive them too deeply.

Another stunt you might find successful is shown in Fig. 6. Here several holes are first bored through the sub-

floor to take snugly the spout of an automobile grease gun which is filled with thinly mixed crack-filler compound. It is best to use a twist drill rather than an ordinary wood bit to bore these holes, as there is less chance of the spur coming through the hardwood floor before a clean hole is made in the subfloor. The spout of the gun is pressed tightly up into the hole and the filler is forced

between the two floors. Be sure to plug each hole as soon as it is filled to prevent the crack filler from being forced out when pressure is applied to adjacent holes. When the filler becomes hard, it will bind the two floors together.

Thrilling Rides in This Wave-Action Swing



Suspended from vertical rocker arms, which in turn are cushioned with discarded auto-spring leaves, this novel swing gives the passenger a long, undulating glide. The stop blocks against which the springs operate can be spaced for the smoothest action. The wood need not even

be surfaced, but below the ground it should be treated with creosote to prevent decay. The axis for the wig-wag supports consists of large machine bolts, with a section of brass tube for a bearing.

Down and Pinfeathers Removed from Fowl with Paraffin

Anyone who dislikes the task of dry-picking ducks and other fowls, can simplify the job with paraffin. After the larger feathers have been removed, and wings, legs and head snipped off, melt a cake or two of paraffin and pour it over the entire bird. The wax hardens quickly, and when removed with the fingers, carries with it all the down and most of the pinfeathers. The paraffin can be saved and used again for the same purpose.

—Ormal I. Sprungman, Minneapolis, Minn.

ⒸBefore measuring sirup, molasses, etc., grease the measuring cup and the ingredients will not stick to it.



Paintbrushes Are Shaped Easily with Coarse Sandpaper



Paintbrushes can be shaped to any desired bevel by first dipping them in glue, letting it harden, and then using sandpaper to shape them. After this has been done, the glue is softened in warm water and washed out. In this way, an inexpensive brush often can be given the beveled edge of a more costly one.

—James F. Ferguson, Oregon, Ill.

Evergreen Branches Decorate Window Flower Boxes

Flower boxes that are attached permanently in place, pass through an unattractive period between the first killing frost and spring. However, the idea of cutting the boughs from the Christmas tree after it has served its purpose, and placing them



in the boxes is gaining favor. The effect is particularly striking in mid-winter when snow covers the ground.

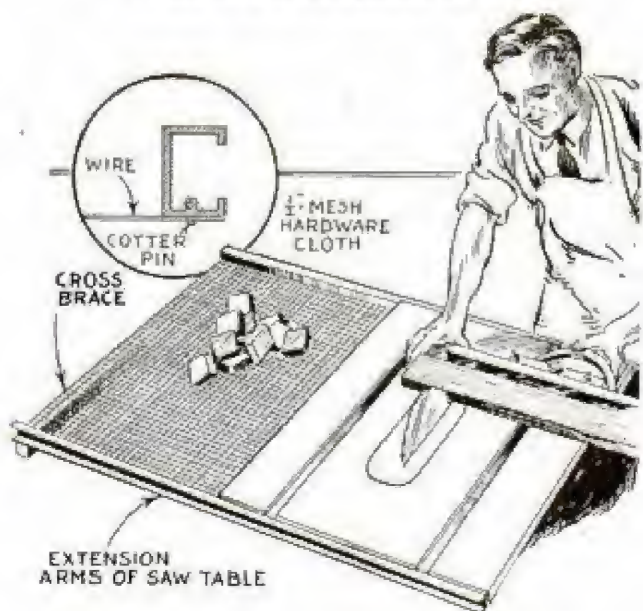
"For Rent" Sign Always at Hand for Use When Needed

Used by the owner of a rooming house who had trouble with his signs becoming soiled or misplaced when set aside, this sign will stay clean a long time and always be ready when needed. It is merely a



section of window roller shade, fastened to the inside rail of the lower sash. Letters are painted directly on the shade, which may be pulled down for display, or rolled up after it has served its purpose.

Mesh Tray on Saw-Table Arms Will Not Collect Dust



Stretched and fastened to the extension arms of your circular-saw table, a piece of wire mesh or hardware cloth makes a handy tray for short lengths of stock. The tray will not collect dust thrown by the blade, and it can be removed quickly, as it is held by cotter pins as indicated in the circular detail.

☛ Pour a good disinfectant down the bathroom drain pipes about once a week to keep them sanitary and odorless.

Circus Elephants Give Child a Ringside Seat



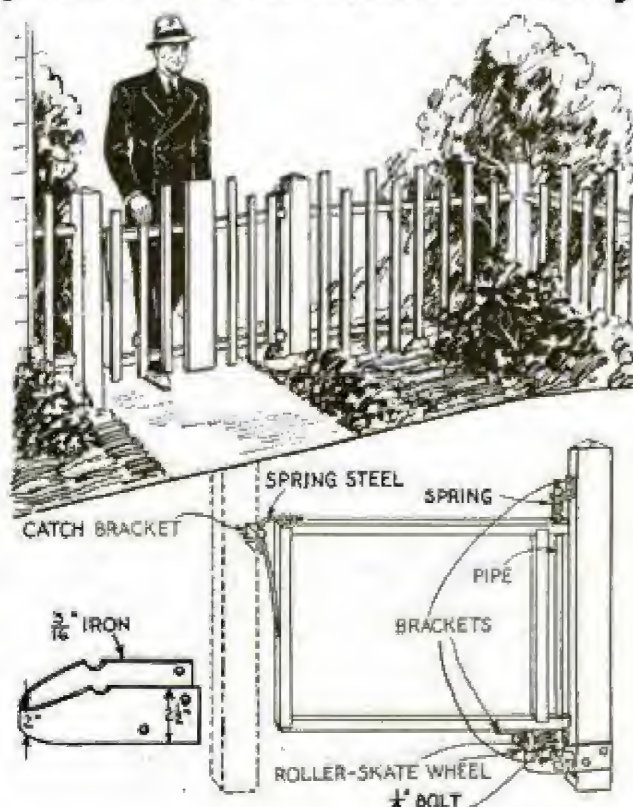
Your small child will take pride in possessing this gaily colored chair, and anyone can make it with a scrollsaw and a screwdriver. All parts are cut from $\frac{1}{2}$ -in. plywood and assembled with flat-head screws. These should be countersunk carefully and puttied over to provide a smooth

surface for paint. The chair looks nice with the elephants finished in light gray and the blankets painted on with a darker gray and bordered with brilliant orange.

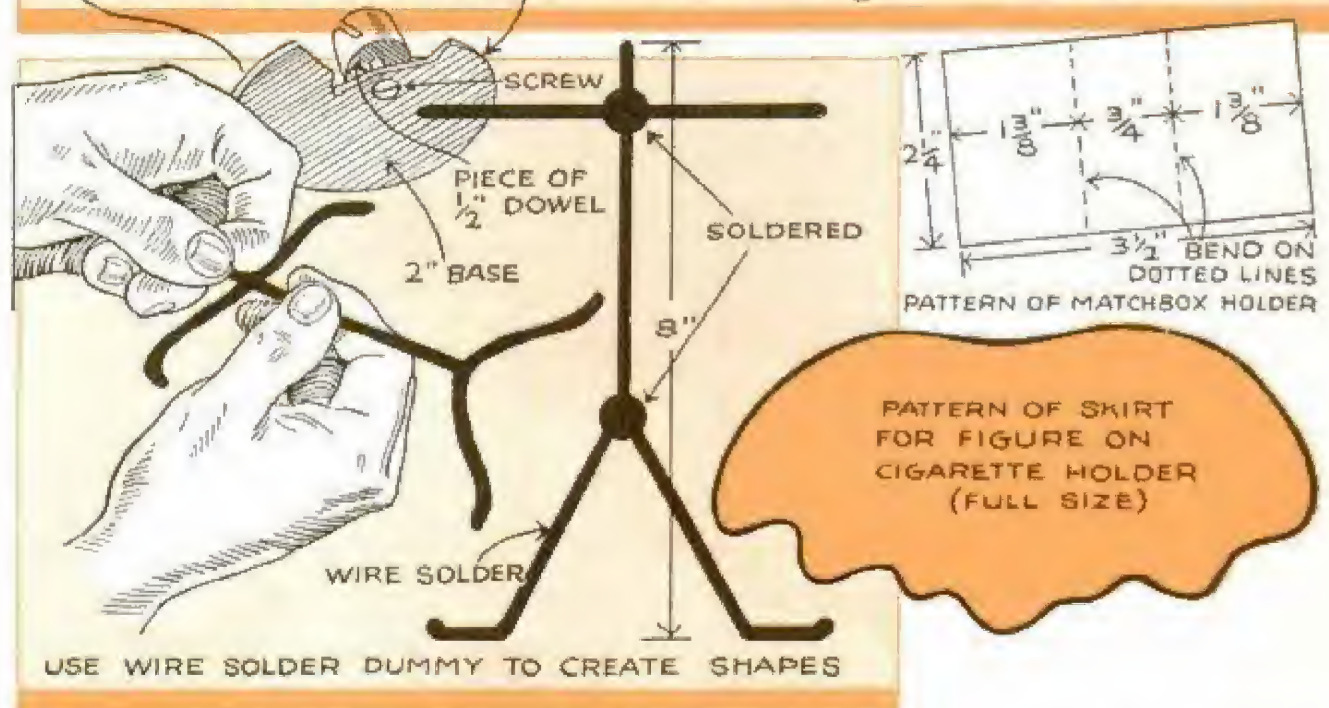
This Yard Gate Opens Easily and Closes Automatically

When you walk through this gate, its own weight causes it to return to the closed position. As shown, a length of small pipe, passing through the top and lower rails at the rear end, is pivoted to the gate post by means of angle brackets. A U-shaped piece of metal, cut as indicated in the left-hand detail, fits around the lower bracket where it is nailed or screwed to the post. This piece serves as a track for a roller-skate wheel, which carries the entire weight of the gate. Due to the shape of the track surface, the gate is raised slightly as it is opened. Therefore, the weight tends to make the wheel seek the lowest level on the track and close the gate. A coil spring between the upper gate rail and the pivot bracket on the gate post is compressed as the gate raises, and furthers the tendency of the wheel to move down the inclined surface of the track.

—Roy Fuller, St. Paul, Minn.



WIRY MIDGETS *decorate*



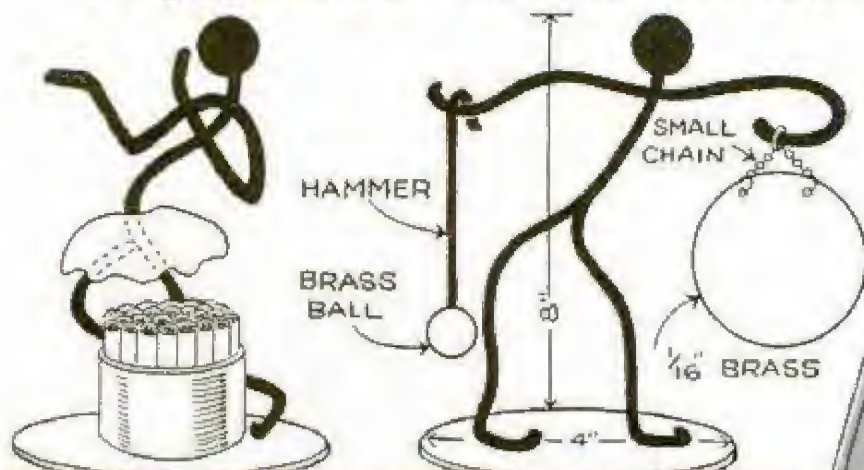
YOU will find many uses in your home for these little ornaments. They are ideal for bridge and party prizes, and, being inexpensive they can be sold in quantities at a good profit for your spare time. The ash tray, place cards, dinner gong, and the holders for a watch, matchbox and cigarettes are only a few of the many variations possible. The illuminated watch holder is a good example of what can be done with a little extra work. The larger figures are made of $\frac{3}{16}$ -in. brass rod, although heavy copper or iron will do in a pinch, or even ordinary wire coat hangers can be used if the figures are enameled.

First make a dummy with wire solder and use this as a pattern in forming the

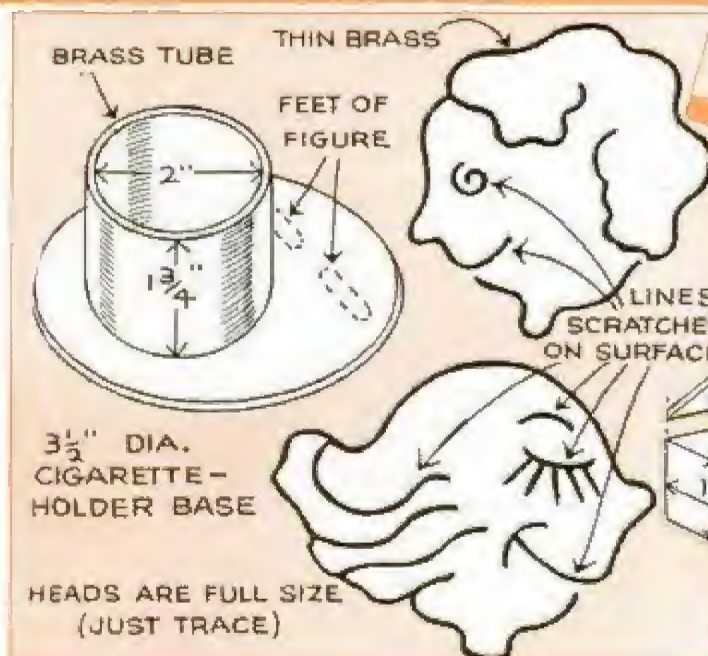
figure. After one figure has been copied, the solder can be straightened and used to form a pattern for another one. If small brass or copper rod is used, some of the body curves can be made with the fingers. Most of the figures consist of only three pieces, which are half-lapped and soldered where they cross. It is better to use a little more solder than necessary as the excess can be filed or scraped off to leave a smooth, strong joint.

Two types of heads are shown. The flat ones are made of thin sheet brass or copper. Hair, eyes, ears and facial features are scratched deeply in the surface. Or, you can use a $\frac{3}{4}$ -in. brass ball to represent a head. This is drilled and tapped to screw

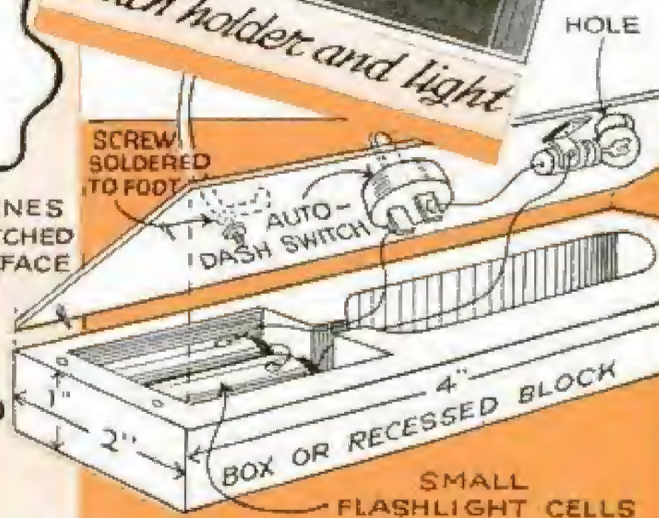
Mantel and Table



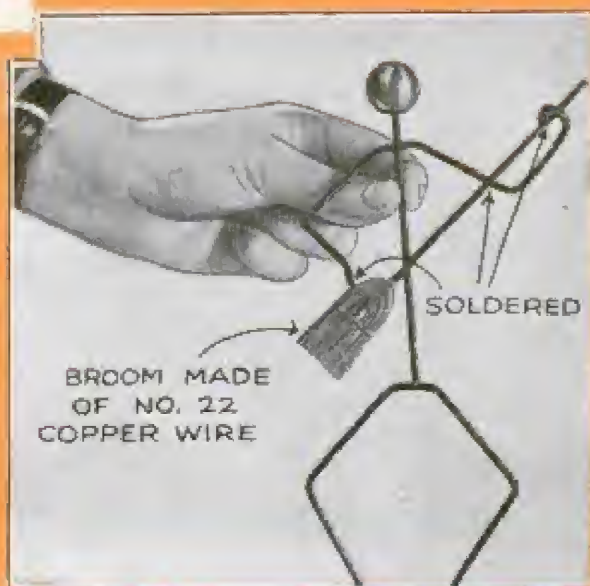
Cigarettes • Dinner gong



Watch holder and light



onto the body, or just drilled and soldered. The bases are $\frac{1}{16}$ -in. brass or copper disks 3 or 4 in. in diameter, and the feet of the figures are soldered to them. The base of the combination night lamp and watch holder is made from a wood block. Two openings are gouged out to take the lamp, switch and flashlight cells, the latter being of the pencil type. A radio pilot light and bracket are fastened in place, and the parts are wired and soldered. These are pressed into place so they will not fall out. The bottom of the base is covered with felt to prevent scratching the furniture. A pocket watch is placed on the hooked end of the hand so that light from the lamp below will shine on the face.



The "banjo broom," above, consists of fine-wire strands soldered to a short length of heavy wire

Design Selector Aids in Matching Pieces of Veneer



Craftsmen who work in veneer will find this a handy tool in selecting attractive designs or patterns. By sliding it over a large sheet of veneer one can get a general idea of the complete design before the sheet is cut. The tool consists of two pieces of wood, $\frac{3}{4}$ by 4 by 12 in., hinged together at the ends. Pieces of mirror of the same length and width are glued to the inner surfaces.—James Gosch, Scotia, N. Y.

Cleaner for Rubber Stamps

A solution of ammonia, 1 part, and water, 2 parts, is ideal for cleaning rubber stamps. The solution will remain in good



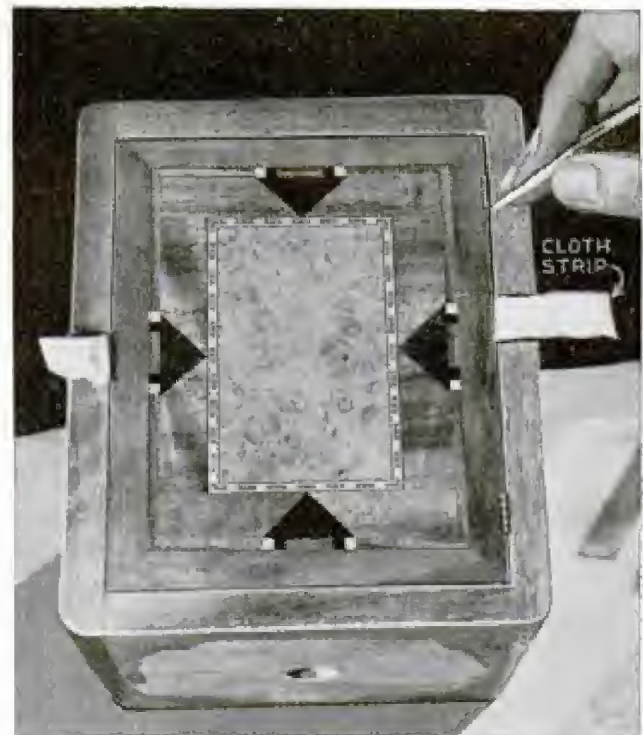
condition indefinitely, and if kept in a bottle that has a swab attached, it is easy to apply to the stamps. Typewriter cleaning fluid should not be used for cleaning stamps as it tends to dissolve the rubber.

Cotter Key Locks Hinge Hasp When Not in Use

To keep the hinge hasp of a door lock folded so it will not catch on your clothing when not in use, bend a cotter key to the shape indicated and drive it into the door just above the hasp as shown in the drawing. The loop portion of the key will serve as a snap latch to hold the hasp.



Fitting Small Cabinet Doors

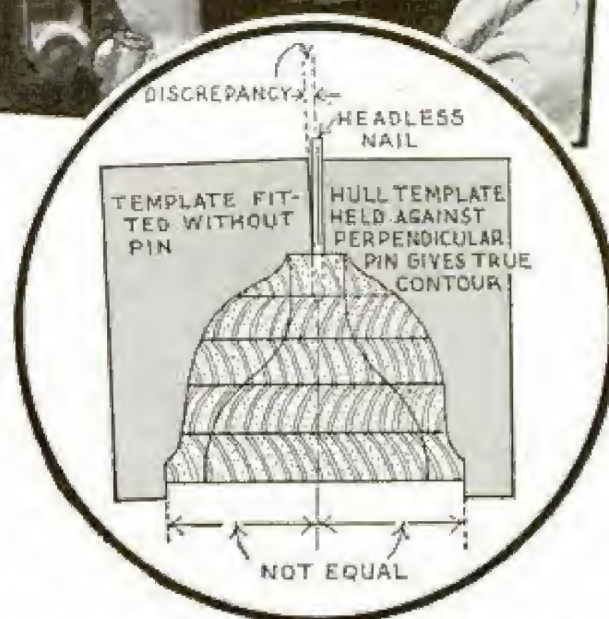
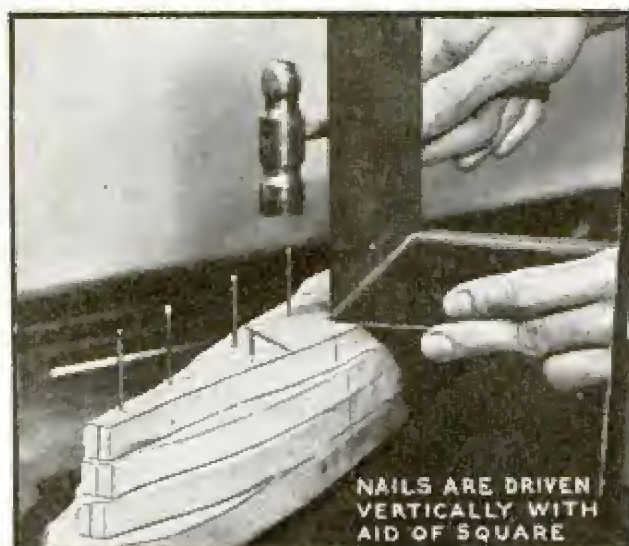


When fitting small doors in cabinets and other places where they are to be a close fit and are to set flush with the outer surface, cloth tabs are handy to lift a door out after it has been set in place to check the fit. The cloth can be a strip laid across the opening before putting the door in place.

—Thomas B. Owens, Cleveland, Ohio.

☞ A dampened sponge will remove lint from clothing quickly and easily.

Template Guides Help in Shaping Ship Model



Fitting contour templates to the hull of a ship model is not only an exacting job, but the methods used ordinarily are inaccurate due to the lack of a base line from which to work. The deck, because of its curves and structures, offers no opportunity as a base to work from, and the bottom of the hull is often too narrow for the purpose. This trouble is avoided, and a proper fit on either side of the hull is assured, if a headless nail about $2\frac{1}{2}$ in. long is driven into the hull along the keel line at each station point. The nails should be checked with a square to assure true vertical alignment, and the templates should be cut with sufficient allowance at the sides

to fit against the full length of the nails. In this way, there is no possibility of the template rocking from its proper position if it is held in full contact with the nail.

Turf Holds Floor of Tent at the Corners Better than Pegs

Where large sections of canvas are employed as floors for tents, the usual pegs may be eliminated. Simply spread the canvas, then fold back the corners and cut sections of turf as indicated. When the turf pieces are raised and the canvas spread again so that the corners drop into the openings, the turf pieces are turned back to hold them securely. If the tent is being set up to be left standing for some time, the corners, or even all of the canvas floor, should be treated with a waterproofing solution.

❏ To avoid damping off and rotting of seedlings, put a packet of flower seeds in a glass jar, add a pinch of copper oxide, then put cover on tightly and shake well, making sure that the seeds are well coated with the powder.



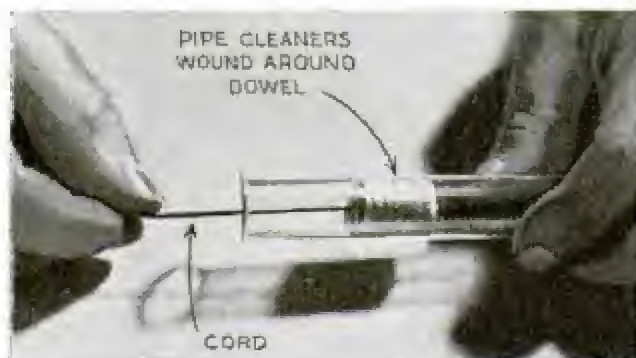
Flowerpot Aids in Killing Ants When Using Chemicals



To get rid of ants in a hill, locate the main opening to the latter and snuggle an inverted flowerpot into the soil over it. Then through the hole in the bottom of the pot, drop carbon tetrachloride at intervals of 30 min. Usually a 2-hour treatment will kill every ant in the opening. Other adjoining openings should be plugged. If this is done in the evening when the ants are in the hill, you will get most of them the first attempt. If you notice ants using the opening a few days after the pot has been removed, repeat the operation. Usually when the main colony has been killed, the few remaining stragglers will leave the locality.

Easy Method of Cleaning Tubes

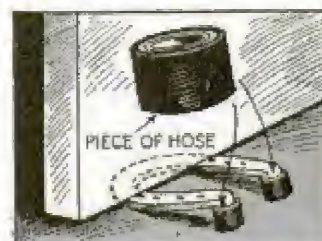
Cleaning the inside of a long glass tube is not difficult if the following method is adopted: Select a short piece of dowel that will fit inside the tubing loosely, and drill it lengthwise so that a long cord can be



attached. Wind the dowel with one or two pipe cleaners, and then pull it through the tube by means of the cord.

Horseshoe with Rubber Calks Makes Efficient Doorstop

An efficient doorstop for a garage or shop door may be made from an old horseshoe from which the toe calk has been worn off or removed.



Although serviceable without further alteration, the shoe may be made more secure by fitting a couple of sections of lawn hose over the heel calks so that this portion of the stop rests on the rubber.

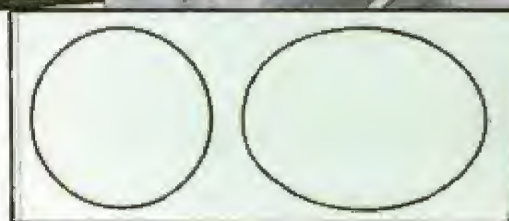
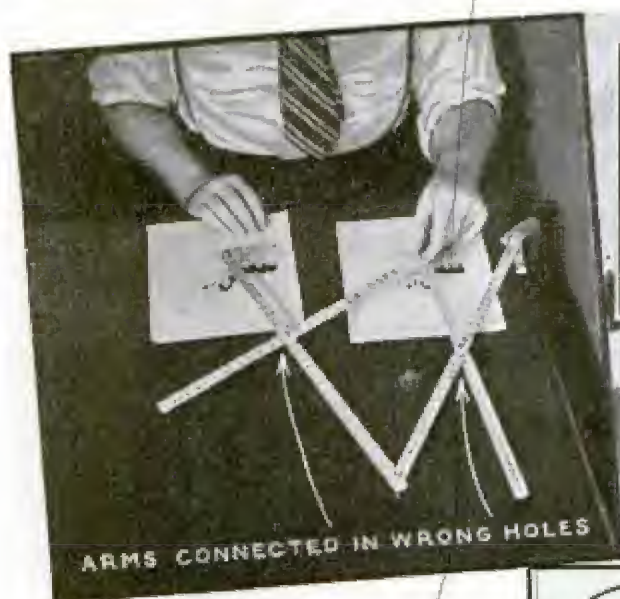
Shear Guide Helps Trim Hedge to Uniform Height



With this simple guide riding on top of the hedge, you will find it easy to keep a hedge trimmed uniformly. Extending metal rods stapled to a trough-shaped board, which straddles the hedge as shown, restrict the depth of the cut.

❑ If a small lump of butter or lard is added to cooked starch, the iron will not stick to the garment when ironing it.

Pictures Amusingly Distorted by Pantograph



OVAL CAN BE FORMED FROM CIRCLE



By using a pantograph you can make distorted reproductions of pictures. Distortion of an oval and the figure shown in the details are good examples. In normal use, when making exact copies of pictures, either enlarged or reduced, the bars of a pantograph are connected so that they form a parallelogram, but by shifting the bars so that they form an irregular shape an endless variety of distortions can be obtained; yet the pictures bear a resemblance to the originals. The distortion lengthens the picture in one direction and contracts it in the other. There is a different degree of distortion for each wrong connection made

with either the left or right-hand joint where the bars of the pantograph cross, and still a third type if both joints are misplaced. Also, there is a different distortion for each position in which the original picture is placed. As the pantograph either enlarges or reduces at the same time it distorts, the oddity of the reproduction is emphasized by the change in size.

—Jay Earle Miller, Chicago.

Cardboard Shields on Bar Clamps Protect Finished Work

When clamping finished work single-handed, and it is necessary to shield the clamps to prevent marring the work surface, I find that short pieces cut from cardboard mailing tubes provide good shields. They serve the purpose nicely, and will not fall off when moving the clamps about.

—Vernon Jones, Columbia, Mo.

Keeping Clothesline Clean

Stranded-wire clotheslines that are used in smoky cities collect soot between the strands and it is almost impossible to get it off. This trouble can be avoided by varnishing or shellacking them. This fills the crevices and leaves a smooth surface which can be wiped clean easily.



GOOD SEAMANSHIP

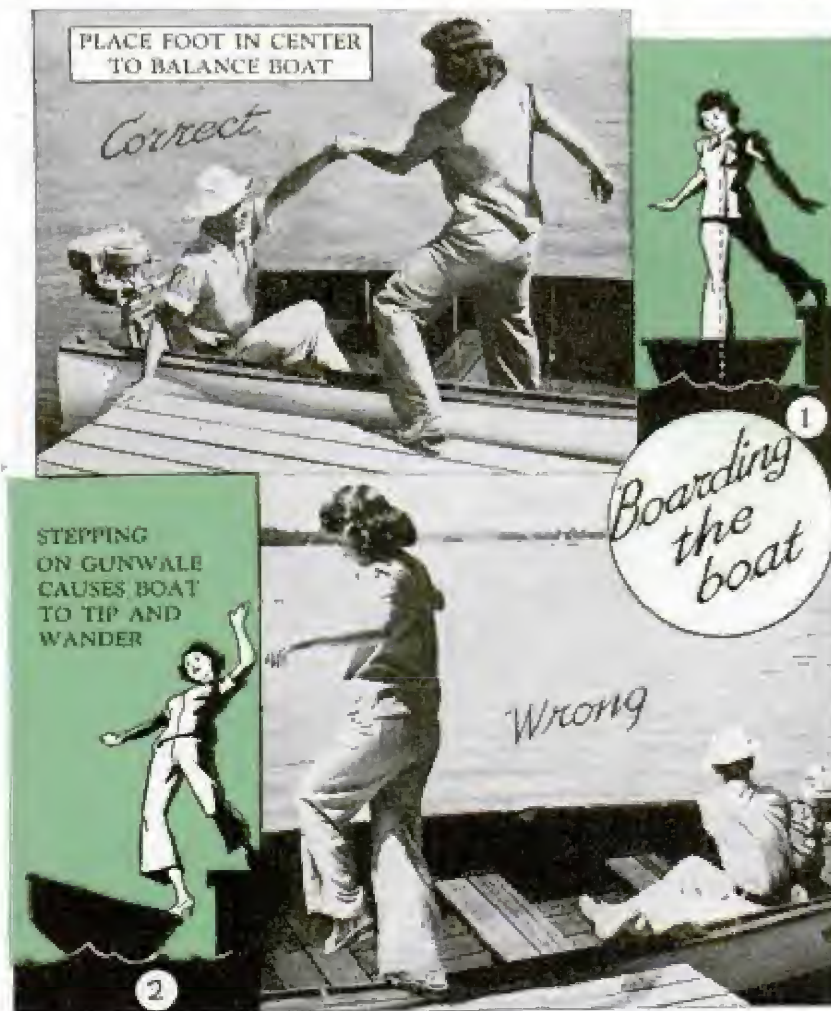


By THOMAS P. LAKE

FIRST attempts at boat handling should be done preferably in a short, wide boat with a broad stern especially adapted for a small, two-cylinder outboard motor.

When stepping into a small boat, always place the first foot in the center of the floor, Fig. 1; never on the gunwale (the rail or outer edge), Fig. 2. Then immediately place

your weight on this foot and crouch down, resting a hand lightly on each gunwale, and sit down. By getting in this way you won't be disturbed by any motion of the boat as it rocks. When getting out, keep one hand on the dock or landing platform if possible, to hold the boat against it. Then rise to a crouching position and step quickly from the center of the boat to the platform, Fig. 23. You move quickly and smoothly to avoid pushing the boat away from the dock and perhaps losing your balance. Also, while transferring your weight from the foot in the boat to the other on the dock, pull the feet together to prevent the boat from being pushed away. The slight thrust given a boat, even when stepping properly from boat to dock or the reverse, is counteracted by this momentary pulling together of the feet. Practice this ma-



in Small Boats

neuver until it becomes automatic.

Operation of an outboard motor is very simple. Turn on the gasoline valve, letting gas flow from the tank to the motor, and then jiggle the primer lever to give a rich mixture for starting. Take a steady pull on the starter rope to get the motor running, Fig. 7. Speed is controlled by shifting the magneto lever, and the motor is stopped by pressing a button which short-circuits the current normally going from the magneto to the spark plugs.

To practice steering safely, tie the bow to the dock, leaving only a foot or two of slack in the painter (the rope by which a boat is made fast). See Fig. 6. Then step in and when seated, push against the dock to swing the stern out until it is at right angles with the dock. Now start the motor, Fig. 7, and run it at very slow speed. The bow is held against the dock by the propeller thrust and the short-tied painter prevents it from slipping far while you study steering effects.



ABOVE: CORRECT LOADING INCREASES SPEED

How to load

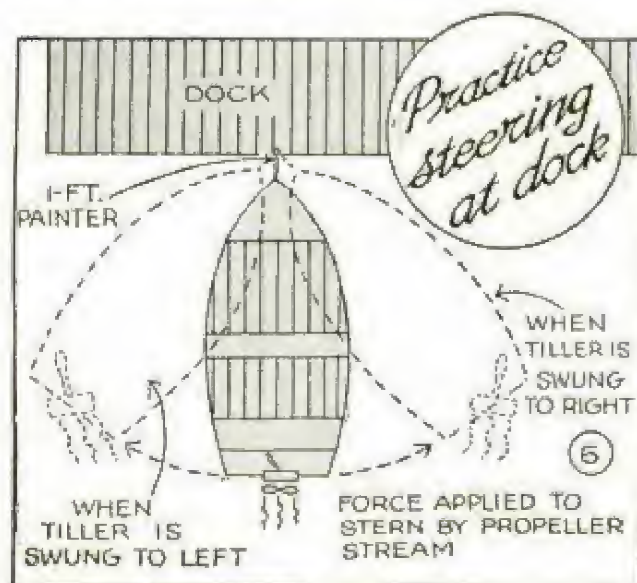


WRONG: BOAT IS HEELED

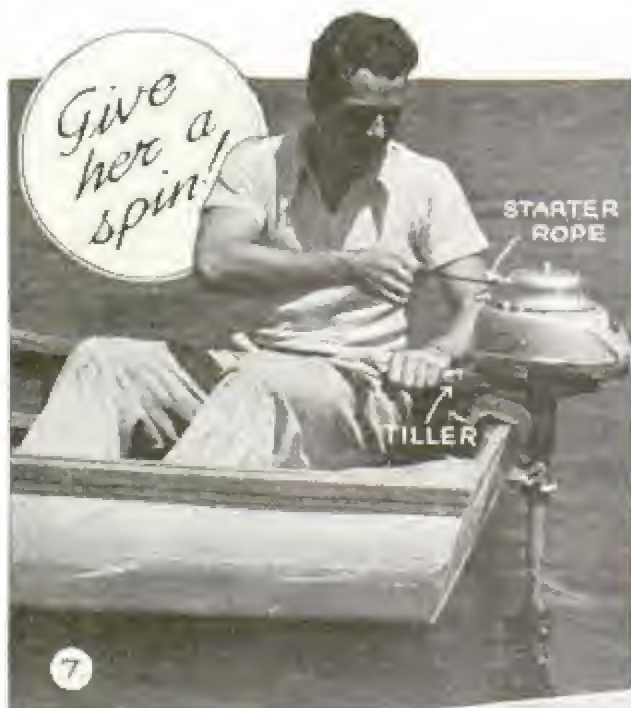


RELAX MUSCLES TO LET BOAT ROCK UNDER YOU

Ride with ease

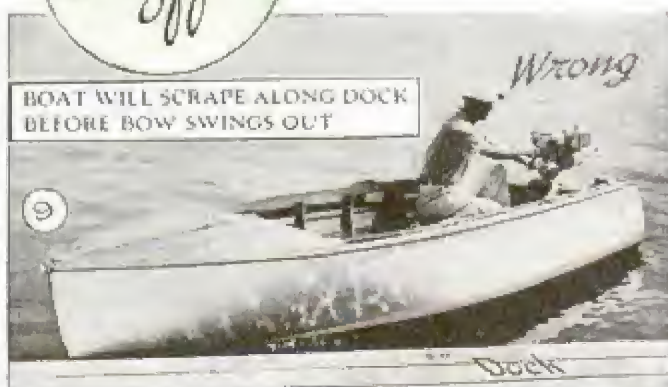


When you are ready to embark on your first voyage, untie the painter, give a slight shove against the dock to push the bow farther away from the dock than the stern, so that when the boat gathers headway (forward motion) the stern will not be swung into the dock if it is necessary to turn immediately. If you are facing forward, as you should be, turn your head and watch the corner of the stern nearest the dock as in Fig. 8. Only when this has drawn clear of the dock can you turn the boat. Avoid scraping of the boat against a dock in a premature turn as might result from the position shown in Fig. 9. If you can't see over the dock from your position in the boat, run slowly and wide of the dock as in Fig. 10 until you have passed the



Shovin' off

ABOVE: WHEN BOW IS PUSHED AWAY, STERN WILL CLEAR DOCK



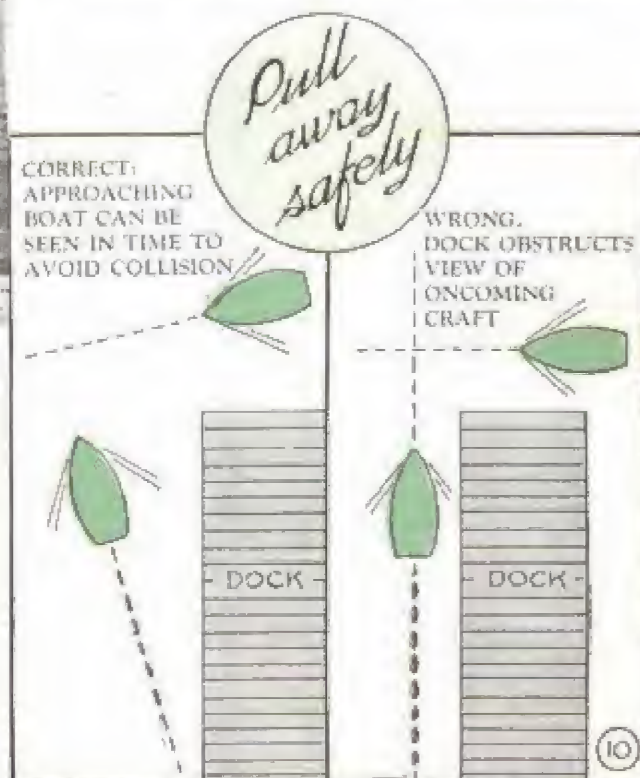
end. If no boat is approaching, you may speed up.

Practice turns in an open stretch of water, Figs. 11, 12 and 13. First make them at low speed. When your course takes you near several large, fast boats, you have the problem of crossing waves made by them. Suppose that a large boat is rapidly overhauling you from behind on your port (left) side as in position A of Fig. 17. Then you alter the course about 30 degrees to the right to put more room between your

courses, as in position B. As the boat goes by, keep an eye on the large, steep-sided bow wave, and as it approaches turn and head for it as in position C. When the wave is immediately ahead, reduce speed so as to give the bow a chance to lift with the impact. Figs. 15 and 16 show the correct and incorrect methods. As the wave rolls past the stern, you swing back to your original course and resume speed.

With a longer boat, and more experience, you might delay turning away from the course of the overtaking craft until it was quite close. Then, as the bow wave approaches, you would swing your bow away, and in doing so present the corner of the stern and side to the advancing wave. The wave would first catch the stern, splitting itself on the corner, and then lift the stern with a twisting motion. This maneuver is called "quartering the wave." The wave then runs forward, dropping the stern and lifting the bow. As the wave slides away from the bow, the original course is resumed. This maneuver is especially adaptable to boats having wide, buoyant sterns, especially when they are loaded so that the weight is concentrated amidships, and not at the ends.

Boats having wide, flaring bows, which are buoyant in meeting waves, permit a different method of crossing bow waves. In the same situation as before, after widening the distance be-

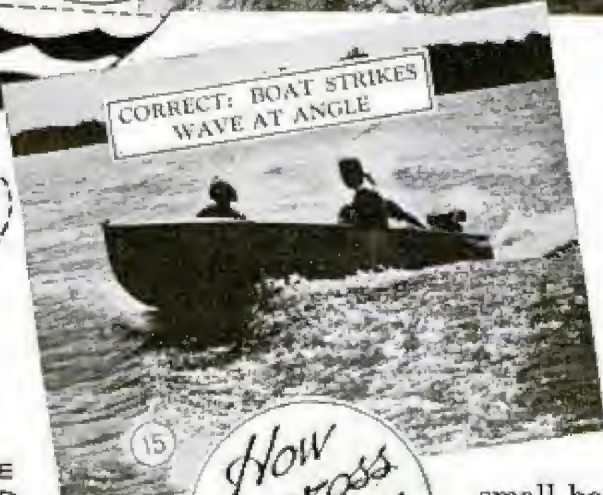
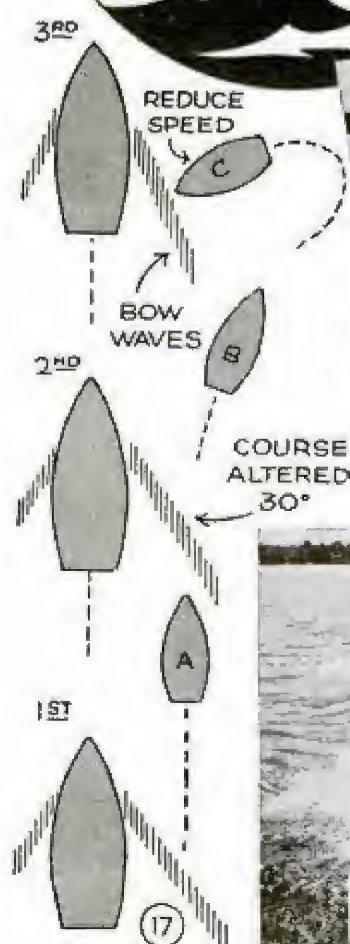
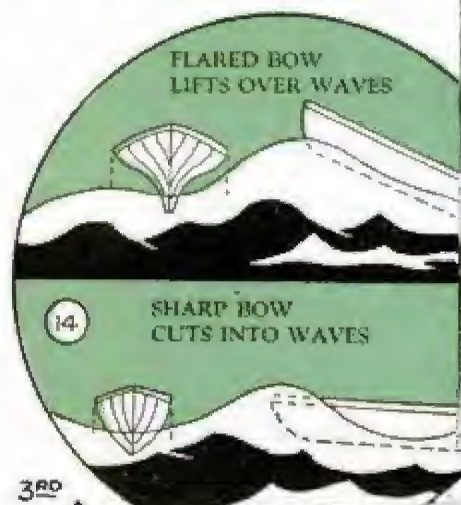


tween the courses of the boats you would angle back toward the approaching bow wave, meeting it broad on the bow (about 45 degrees from dead ahead). The wide flare throws the spray outward and imparts a sharp lift to the bow, usually sufficient to clear the crest of the wave completely. A narrower or straight-sided bow would have cut into the wave, and several buckets of water might come on board. See Fig. 14. Crossing a wave at an angle will cause

Making turns



ABOVE: STARTING A SLOW-SPEED TURN. LEFT: GETTING A HIGH SPEED TURN UNDER WAY. BELOW: SLIDING UP ON BOW WAVE, OR BANKING



CORRECT: BOAT STRIKES WAVE AT ANGLE

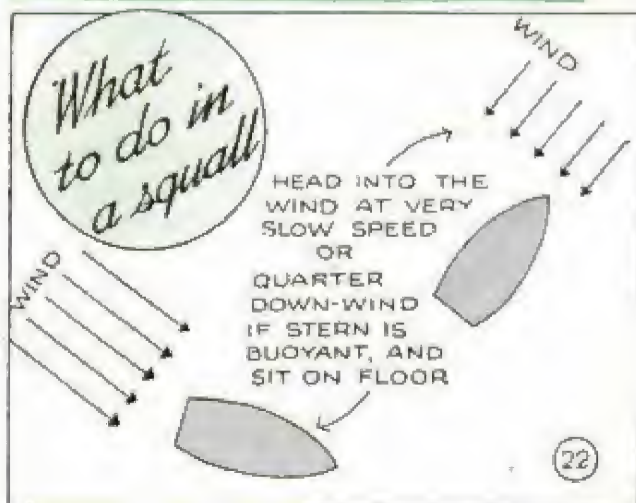
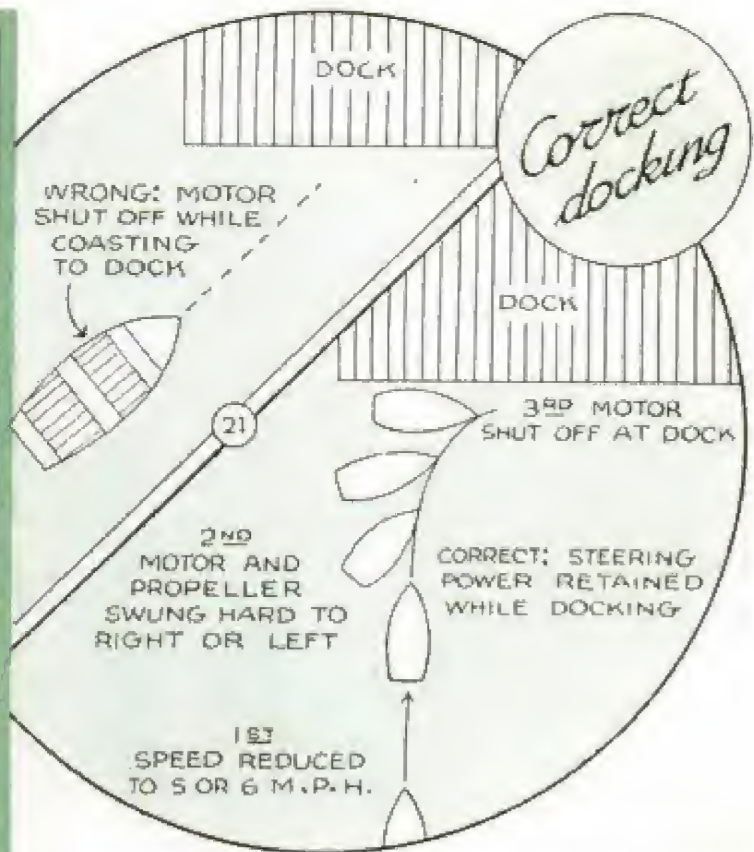
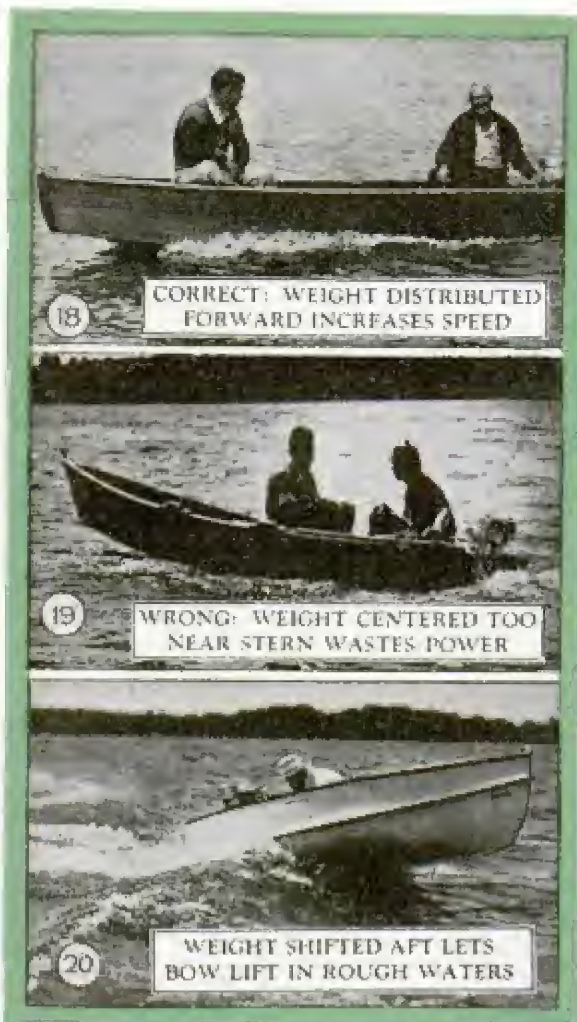
How to cross a bow wave



WRONG: TOO MUCH SPEED, BOW CUTS INTO WAVE

a small boat to rock. Sit upright and keep the eyes on the shore ahead. Relax the muscles and let the boat rock under you. See Fig. 5. This means considerable bending at the waist, but it soon becomes an automatic action.

The instinctive but wrong way to dock a small boat is to head for the dock and shut off the power when it is estimated that just sufficient headway remains to headreach (coast ahead) to the dock, Fig. 21. The correct way is to head for the dock at very nearly the place at which you want the boat to lie. Throttle down to about 5 or 6 m.p.h. When a length and a half from the dock, and collision seems inevitable, suddenly throw the steering lever hard over to one side, so that the propeller is facing about 60 de-



grees from astern. The stern immediately begins to swing around the bow. Hold this steering angle and slow the motor to dead slow. By this time the forward motion of the boat is almost entirely lost, and the boat is at right angles to its original course. It is now parallel with the dock, and not more than several inches from it. Then, before the boat begins to develop headway, shut off the motor. There is only one variable factor in this method of swinging in toward a dock to kill headway—the weight of the load. A heavily loaded boat usually requires more room to slide sideways, and may be sluggish in responding to the hard-over helm (actually the tiller controlling

the rudder, but may be applied to the steering lever of an outboard motor). Longer boats may approach the dock at an angle of 45 degrees or even less before they throw the helm hard over because they have more grip on the water and require less turn to make them lose headway. Notice how boats with inboard engines accomplish this same maneuver with a hard-over rudder and then

quickly reverse the engine to kill headway.

Distribution of the load in a boat must be varied to meet conditions. The boat should ride level and well balanced as in Fig. 3, not as in Fig. 4. Fast boats that plane on the surface usually require a weight well forward to maintain the level running condition. Round-bottom boats usually develop more speed if they are loaded with enough weight forward to let the stern lift at speed until it is no deeper than the bow. See Figs. 18 and 19. The manner in which the bow rises to meet waves can be altered by changing weight fore and aft. A light bow will rise quickly. Make use of this fact if you must run in rough water as in Fig. 20. If water still comes over the bow, run at reduced speed.

If you have no time to get to shelter before a squall hits, stow all loose gear securely and lower the center of gravity by seating two or three persons on the floor. Head the boat directly into the wind as in Fig. 22, and reduce the speed so that you just have steerageway (headway sufficient for control by propeller or rudder). The sharp blasts of a squall rarely last more than ten minutes and often they are only of one or two minutes duration. As long as the wind blows severely, keep the boat headed into it. When it lets up, turn and head for the nearest shelter, but stop and head into the wind again if more blasts come. If the stern is quite buoyant it is possible to quarter very slowly with the wind. Running with the wind and waves will be determined by how much water slaps over the stern. Stay out of narrow or congested waters during a squall unless you can get shelter from the wind and waves there.

Cellophane Pocket on Paper Bag Holds Shopping List



A square of Cellophane attached to the side of your paper shopping bag with gummed tape makes a handy pocket for a shopping list. The list can be consulted without removing it and there is little danger of it being lost.

Novel and Serviceable Baby Crib Made from a Barrel



This unusual baby crib was made from a barrel, at small expense. One side was sawed out as shown, after which the barrel was bolted to a wooden frame of pine. The staves are painted white and the hoops black to give the crib a very neat appearance, and if desired, the inside can be lined with padding and cloth.

Bicycle Handlebars Protected with Rubber Rings

Cyclists who often lean their bicycles against a masonry wall, will find that the polished surfaces of the handlebars can be protected against scratching on the rough



walls if rubber rings are slipped over them. The rings are slid to the portion of the handlebar that will touch the wall when the bicycle is parked.—H. V. Beust, Locarno, Palazzo Meschini, Switzerland.

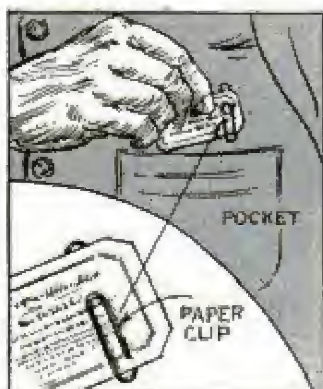
Emergency Casting Rod Is Made from Bamboo Pole



While on a fishing trip I broke my casting rod, and, being unable to purchase another in the vicinity, I made one from an ordinary bamboo pole. I split three strips $\frac{1}{2}$ in. wide from the pole, 2, 3 and 5 ft. in length. These were fitted together concave side down with the shortest length on the underside, and were bound tightly together with electrician's tape. Guides were shaped from short pieces of wire and fastened to the rod with a few turns of tape. The reel was also fastened to the rod with the tape. If no tape is available, a stout cord will do the trick.

—G. E. Hendrickson, Jr., Argyle, Wis.

Clip Prevents Loss of Ticket Carried in Pocket

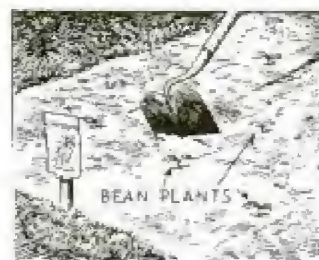


When carrying a railroad ticket or other small piece of cardboard in the pocket, slip a wire paper clip over it as indicated. The weight of the clip tends to keep the ticket from slipping out

of the pocket. Also, the ends of the ticket tend to catch in the cloth of the pocket as a further protection against loss.

Beans Serve as Markers in Rows of Slow-Growing Seeds

Because the slow growth of carrot seed often left him in doubt as to where he could cultivate safely before the plants showed above the ground, one gardener planted a few string beans in the same trenches. These seeds grow rapidly and when one or two of them are planted about a foot apart all along each row, their appearance in a few days serves as a marker.



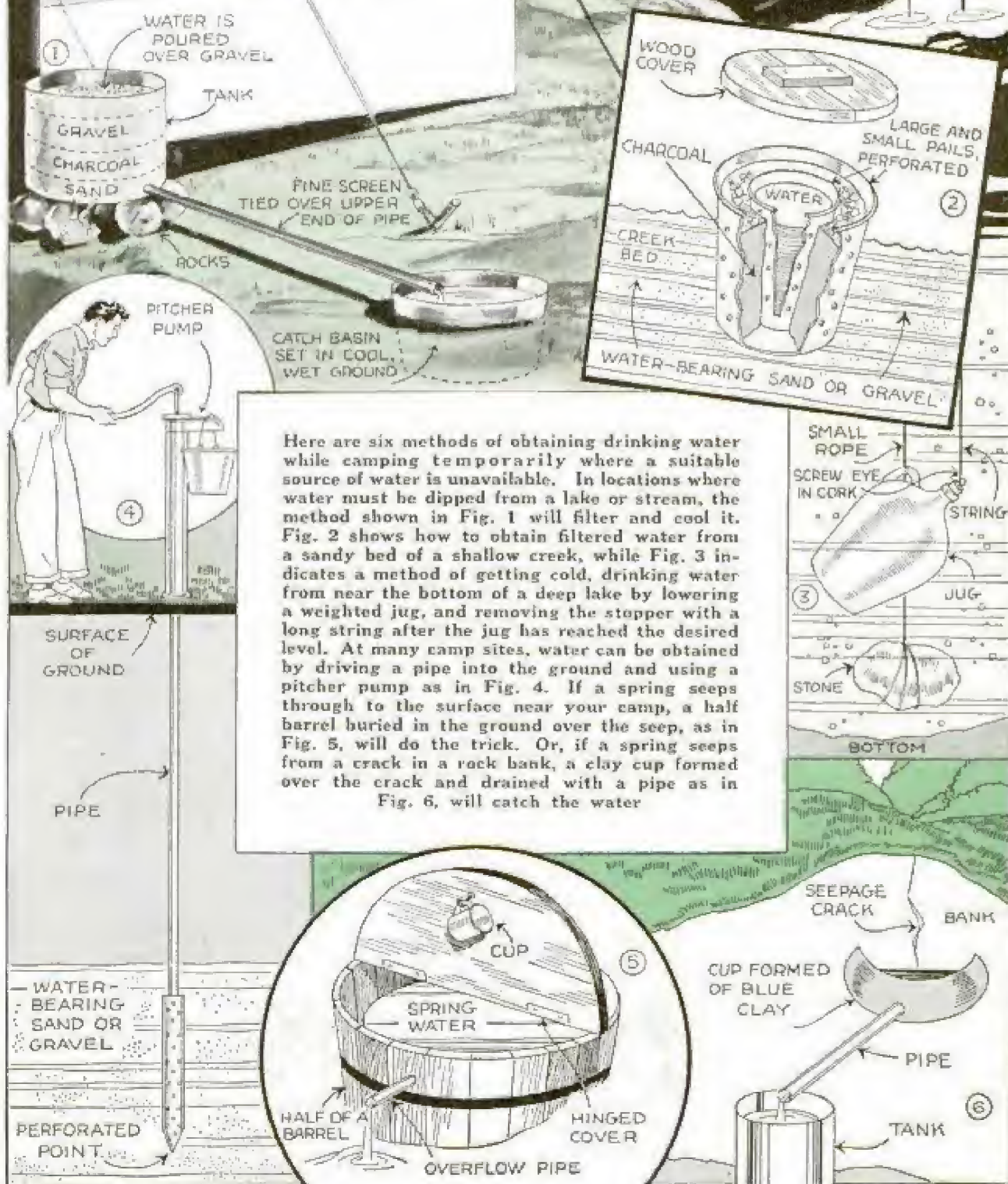
Stovepipe Tee Used as Camp Stove



By cutting the edge of one end of a stovepipe tee, as shown in the drawing, and bending out the serrated points to increase the diameter and afford sufficient draft, you have a convenient stove for your camp cooking. A small frying pan or kettle will rest securely upon the opening to utilize all the heat that may be generated. Fuel is inserted through the horizontal opening.

¶ You will find that narcissuses like to grow among the roots of other plants. They flourish excellently tucked in here and there among perennials in the garden, or at the base of the shrubbery border.

The CAMP WATER Supply



Here are six methods of obtaining drinking water while camping temporarily where a suitable source of water is unavailable. In locations where water must be dipped from a lake or stream, the method shown in Fig. 1 will filter and cool it. Fig. 2 shows how to obtain filtered water from a sandy bed of a shallow creek, while Fig. 3 indicates a method of getting cold, drinking water from near the bottom of a deep lake by lowering a weighted jug, and removing the stopper with a long string after the jug has reached the desired level. At many camp sites, water can be obtained by driving a pipe into the ground and using a pitcher pump as in Fig. 4. If a spring seeps through to the surface near your camp, a half barrel buried in the ground over the seep, as in Fig. 5, will do the trick. Or, if a spring seeps from a crack in a rock bank, a clay cup formed over the crack and drained with a pipe as in Fig. 6, will catch the water.

Dog Holds Log Firmly in Sawbuck While Cutting Stove Wood



Anyone who has been annoyed when sawing stove wood by having the logs roll and twist, can avoid the trouble by using a dog attached to one end of the sawbuck. The dog is shaped from flat iron, and it should work freely on the bolt that pivots to the frame.

—Wade M. Gustin, Big Creek, Ida.

Measuring Butter in a Cup

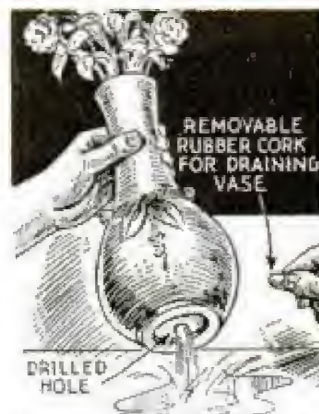


The next time you want to measure a half cup of butter or lard, just fill the cup half full of water and then add butter in pieces until the water has been raised to the full line on the cup. If the amount of butter desired is less than one-half cup, fill the cup with water to the desired height and then add butter to raise the water level to twice that height. This method of measuring is accurate and saves the time required to pack the butter in the cup and

then dig it out again. This is especially true if the butter is cold and hard, because you can add pieces of any shape as they will displace the water and cause it to rise in the cup a distance equal to their total volume.—Wm. Swallow, Brooklyn, N. Y.

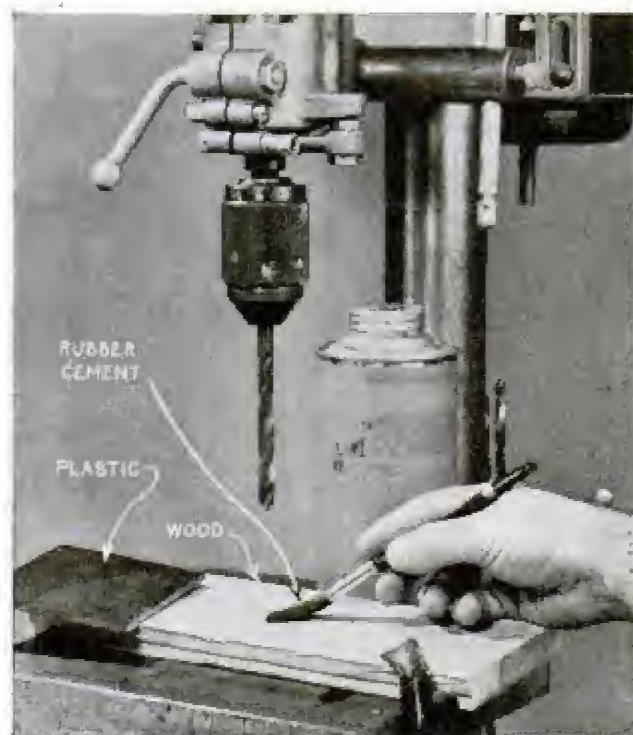
Hole in Bottom of Flower Vase for Draining Water Easily

To change the water in a vase of flowers without disturbing the bouquet, just drill a hole in the bottom of the vase and plug it with a rubber stopper. The flowers also may be freshened by setting them under a faucet and allowing the water to run slowly through the vase for a few minutes before replacing the stopper.



Plastics Held for Drilling by Rubber Cement

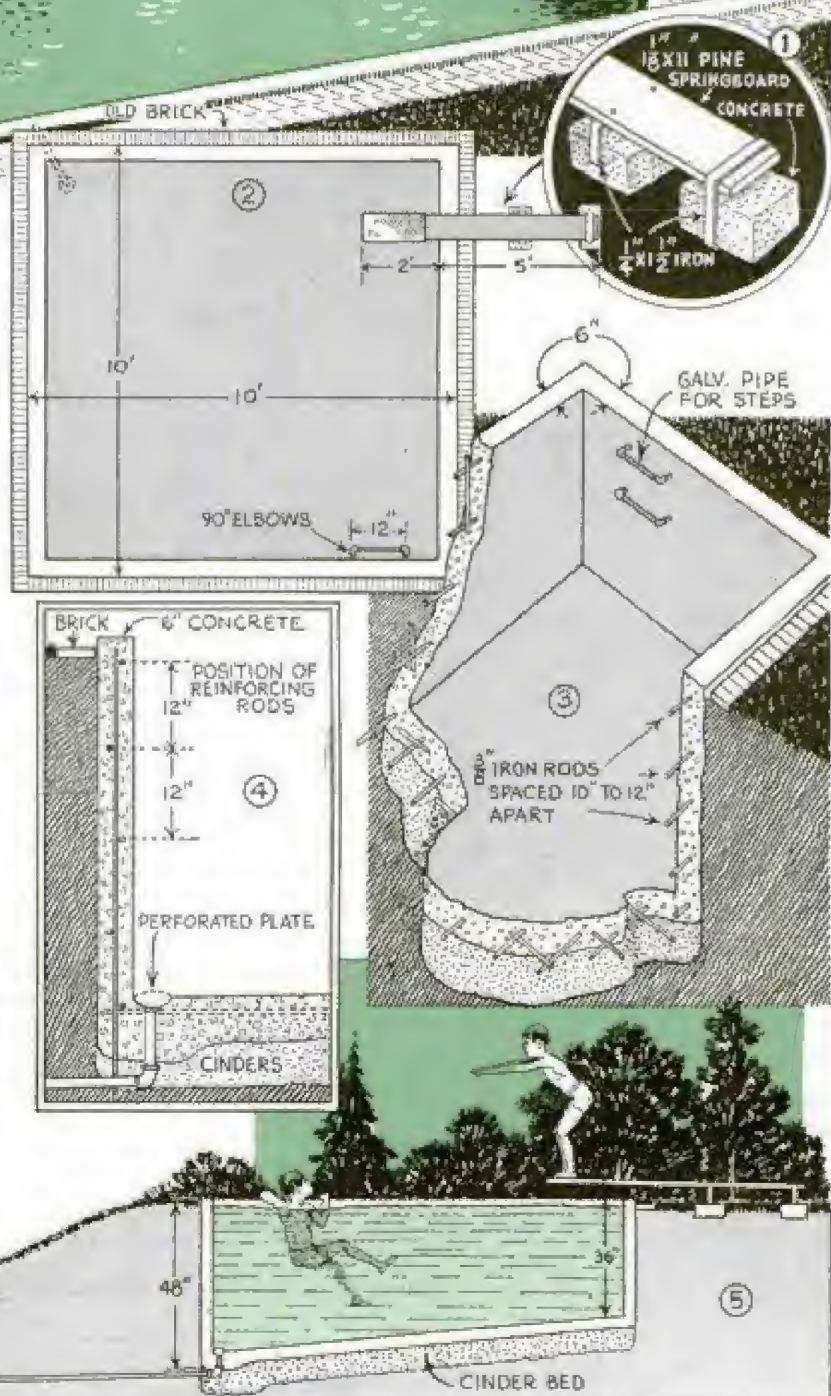
The tendency of plastics to slip around when drilling them, can be avoided by using rubber cement. A scrap piece of wood is clamped to the drill-press table and is given two or three coats of the cement. When this dries, it will provide a smooth non-slip surface.

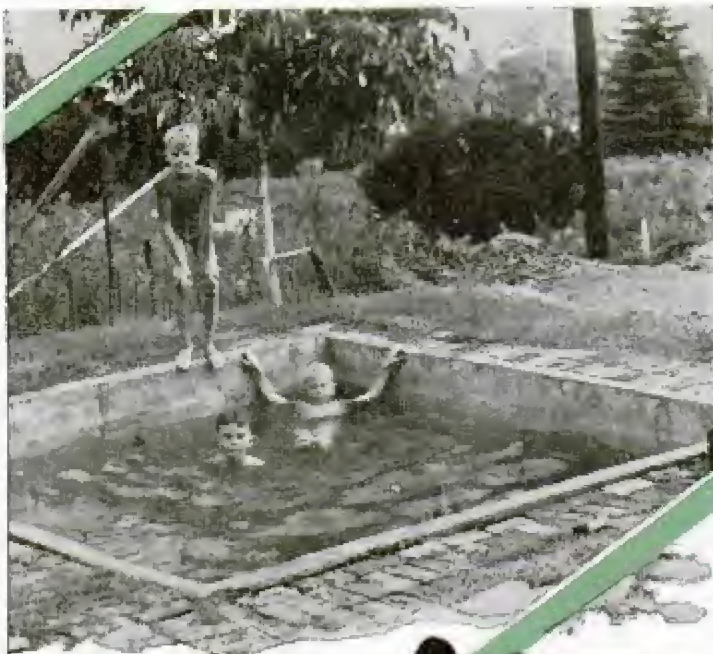




THIS small pool is sufficiently large for children to learn to swim. If possible, you can connect the drain to the city sewage system, and this should be taken into consideration when determining the location. Also, it is advisable to have the pool on ground slightly higher than the surrounding grade, as water splashed out will drain away and the pool will not be flooded by rains.

A plan view is shown in Fig. 2. If the soil is firm no outside forms are needed. The bottom of the pool slopes from a depth of 3 to 4 ft. as shown in Fig. 5. As you will notice in Figs. 8 and 9, the forms are suspended from planks laid across the excavation. Cheap, yellow-pine sheathing and 2 by 4-in. uprights are used to make the forms. The lower edge should be about 12 in. above the bottom. A galvanized-iron drain

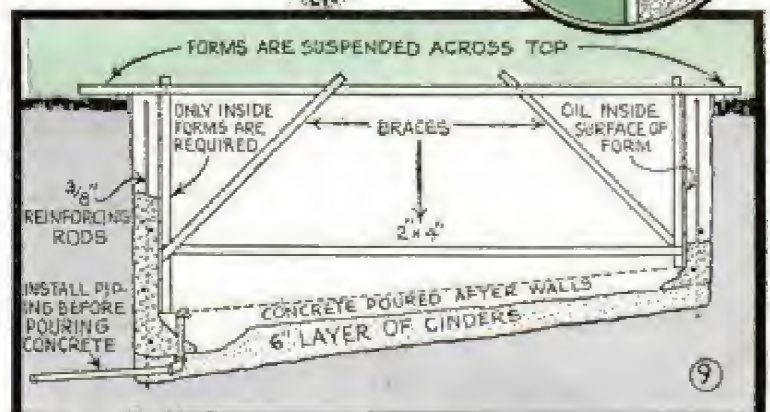
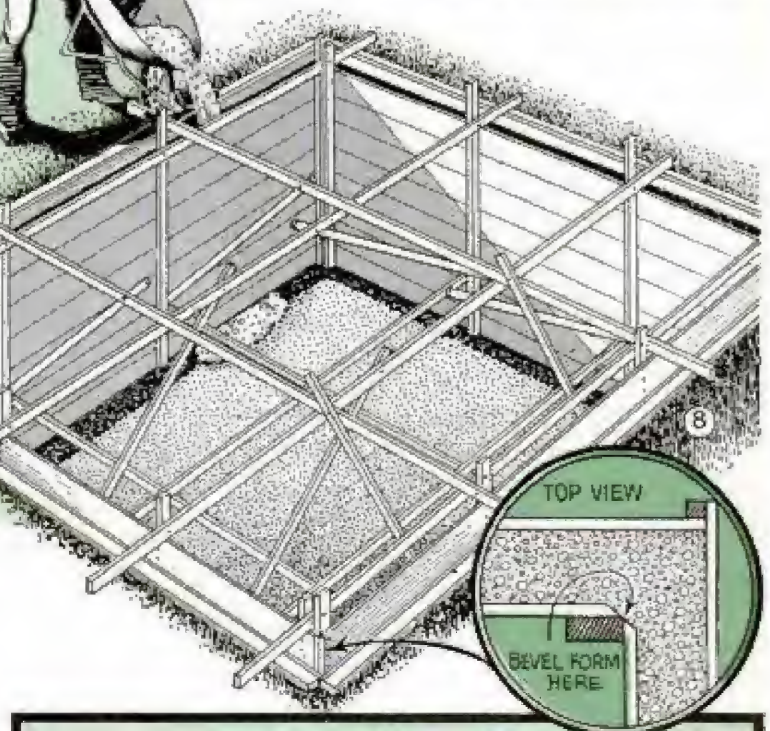


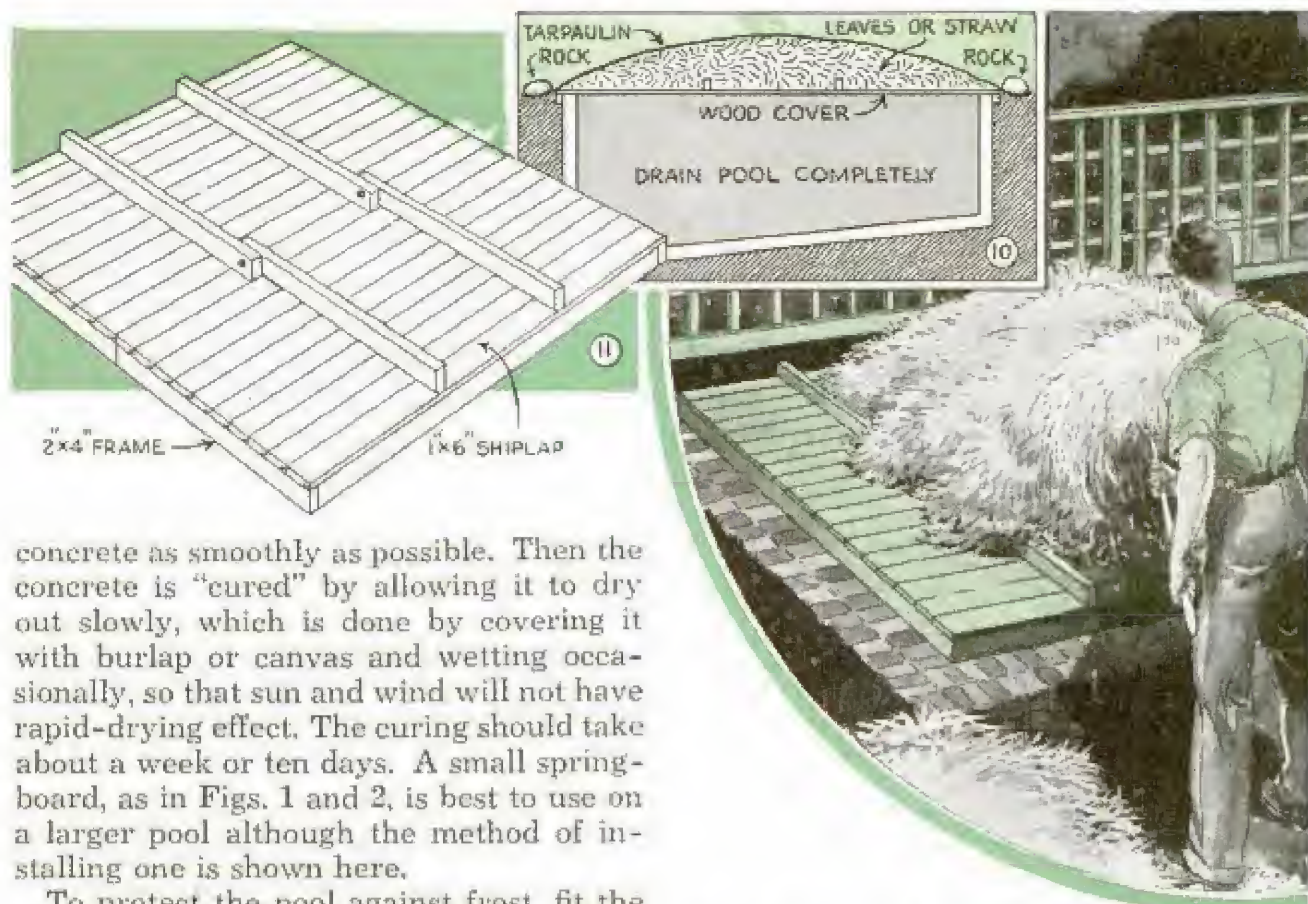


pipe should be installed at the deepest end of the pool and then a 6-in. layer of cinders or gravel is tamped firmly on the bottom. For reinforcement, use either standard $\frac{3}{8}$ -in. iron rods, spaced 10 or 12 in. apart, No. 40 wire mesh, or heavy wire fencing. Rods set vertically in the walls are stood upright by sinking them partly into the soil, while those laid horizontally are set in place as the filling progresses. See Figs. 3, 4 and 9.

Fig. 6 shows a platform that can

be used for mixing the concrete if you do this by hand, and the same platform can be used later as a cover for the pool. A measuring box as shown in Fig. 7, which holds slightly more than 1 cu. ft., helps in proportioning the dry mix, while a pail marked in gallons is used for water. A 1-2-3 mix—cement, sand and gravel respectively—is recommended. A 6 to 8-in. layer of concrete is poured at a time and then tamped. While, or immediately after, the walls are poured, also proceed to lay the floor so that the two will bond together. When the bottom is covered to a depth of 3 in., lay in the bottom reinforcing rods at right angles to each other as in Fig. 3. A depression or sump should be made in the concrete around the drain. A perforated plate should be provided over the pipe opening to prevent clogging. After about 24 hrs., the forms are removed and a finishing coat of equal parts of sand and cement is troweled on the



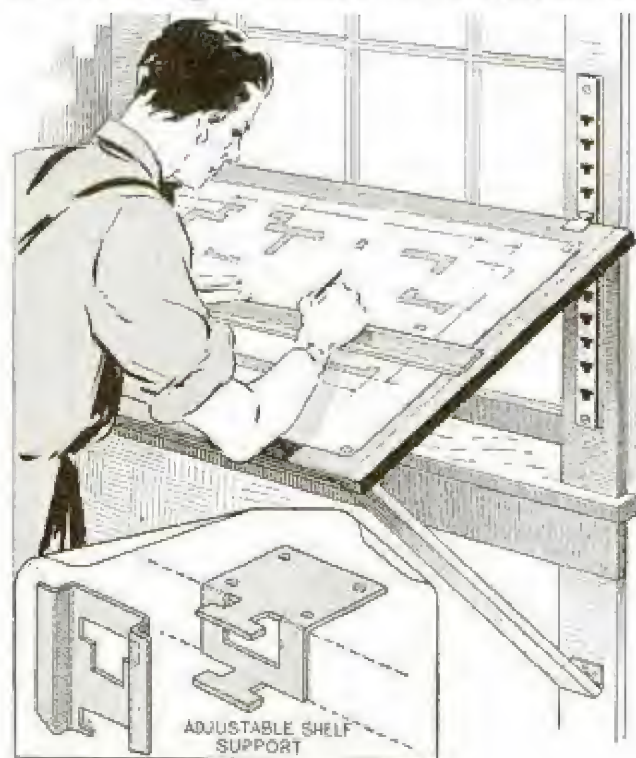


concrete as smoothly as possible. Then the concrete is "cured" by allowing it to dry out slowly, which is done by covering it with burlap or canvas and wetting occasionally, so that sun and wind will not have rapid-drying effect. The curing should take about a week or ten days. A small spring-board, as in Figs. 1 and 2, is best to use on a larger pool although the method of installing one is shown here.

To protect the pool against frost, fit the top with a wooden cover as in Fig. 10. This can be made in two sections, Fig. 11, which are bolted together. Leaves or straw piled over the cover are held in place with a tarpaulin or wire mesh which is weighted down with large stones. Frequency of changing the water depends upon how much the pool is used. It is recommended

that the water be changed at least once a week. Where several children in the neighborhood bathe in the pool, it is advisable to disinfect the water. The proper information as to the kind and correct proportions of chemicals used in sterilizing public pools, can usually be furnished by local or state health authorities.

Drawing Board Mounted on Window Frame Is Adjustable



Using metal shelf supports of the type shown, I improvised a handy, adjustable mounting for a drawing board on a window frame. Braces hinged to the wall rest against cleats on the underside of the board to support the outer edge. This arrangement permits the board to be removed when not in use, yet does not mar the appearance of the window too much.

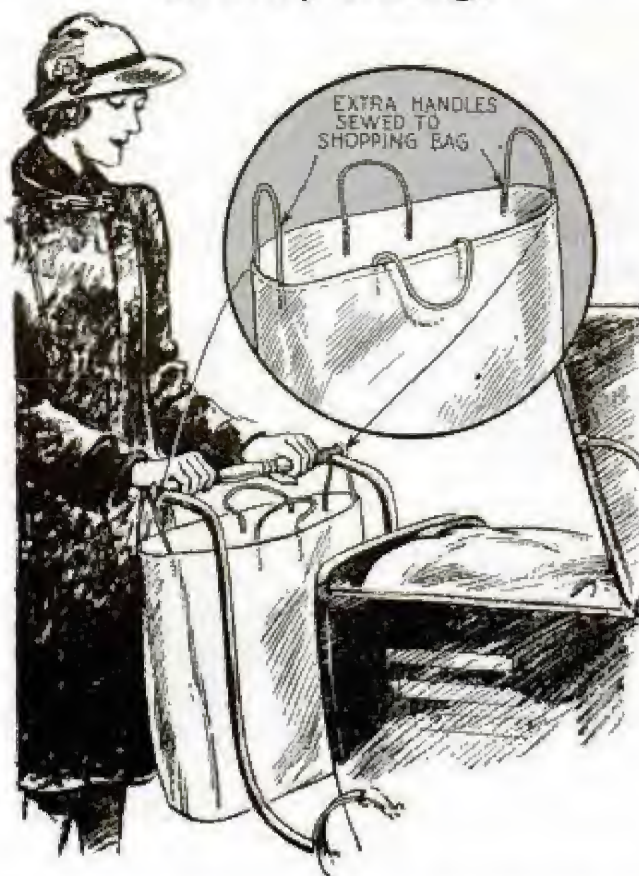
—Leon D. Kaufman, Los Angeles, Calif.

Utilizing Scrap Soap Pieces

We have found that one of the little aluminum containers used to hold tea in a pot is very useful for washing dishes. Several scrap pieces of soap that are usually discarded are put into the container, which is then swished around in the dishpan until sufficient suds are made.

—Emerson Easterling, Ashland, Ore.

Extra Loops Hold Shopping Bag on Baby Carriage



For greater convenience in carrying a shopping bag, while wheeling a baby carriage, one mother stitched extra loops to the bag in the positions shown. When slipped over the handle of the carriage the loops supported the bag safely without further attention.

Sheets of Metal Taped Together to Cut Duplicate Patterns

Instead of cementing several sheets of metal together for cutting duplicate patterns on a scroll saw, try joining them with adhesive tape at the edges. The tape may



be used several times before it has to be discarded, and is much faster and less messy than cement.

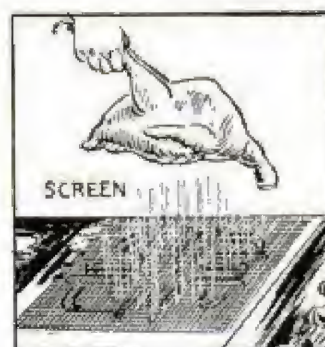
Grommets Made from Tape

Substitutes for rubber grommets, used in protecting electric cords where they pass through holes drilled in metal, can be made with rubber splicing tape. Just wrap one turn of the tape around the wire or a suitable form, and press the edges together. Then roll each end toward the center. Grommets of almost any size desired can be made in this manner.



Screen Prevents Scorching of Fowl When Singed over Open Fire

When poultry is dressed for the table, it is a common practice to singe the birds,

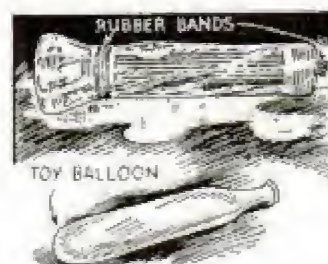


after the feathers have been plucked, to remove fine hairs which are almost invisible. If this is done over an open flame, the flesh of the fowl may be badly scorched. To avoid this, place a piece

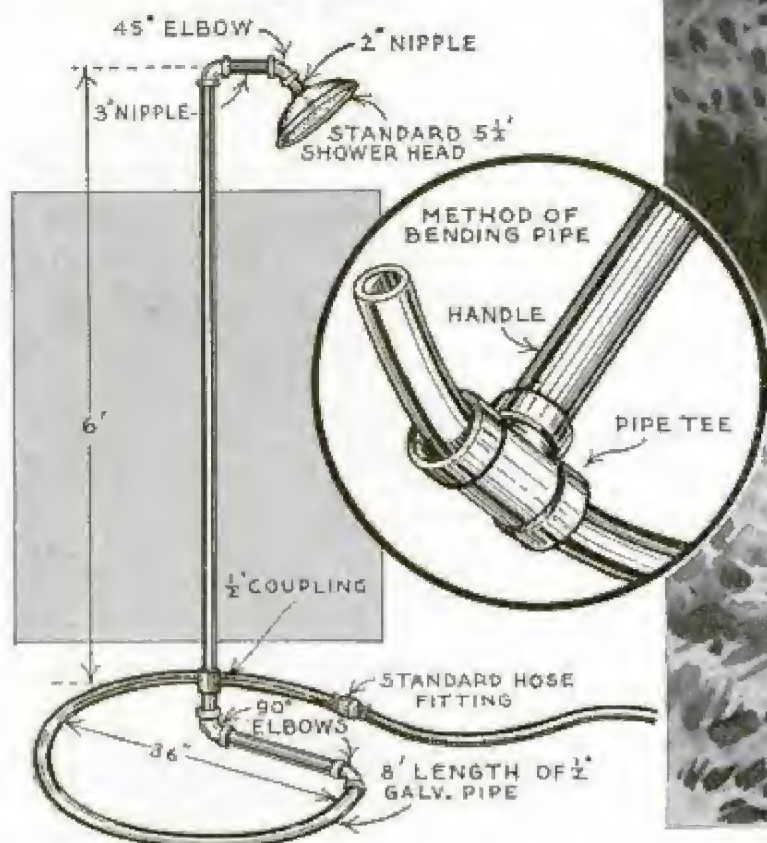
of screen wire over the flame. This will allow the heat to accomplish the work as quickly, and with no danger of scorching or burning. The screen also protects the worker's hands from the flames.

Balloon Waterproofs Flashlight

A flashlight that is to be used where it is likely to get wet, such as around a camp or a boat, can be rendered waterproof by merely inserting it into a transparent toy rubber balloon. The end of the balloon is tied, and the switch can be operated right through the rubber.—Andrew Vena, New York, N. Y.



Portable Shower Cools Kiddies on Hot Days



This portable lawn shower is just the thing for small children on hot days because it can be connected to a garden hose and set in a shady place on the lawn. In addition to this, the water that runs through the shower falls on the grass and is not wasted. In fact, it can be used as a

combination sprinkler for the lawn and a shower for the children. It is made from pipe bent and assembled as shown, using a standard shower head at the top. The circular detail shows how a piece of pipe and a tee can be used to curve a length of pipe to form the base.

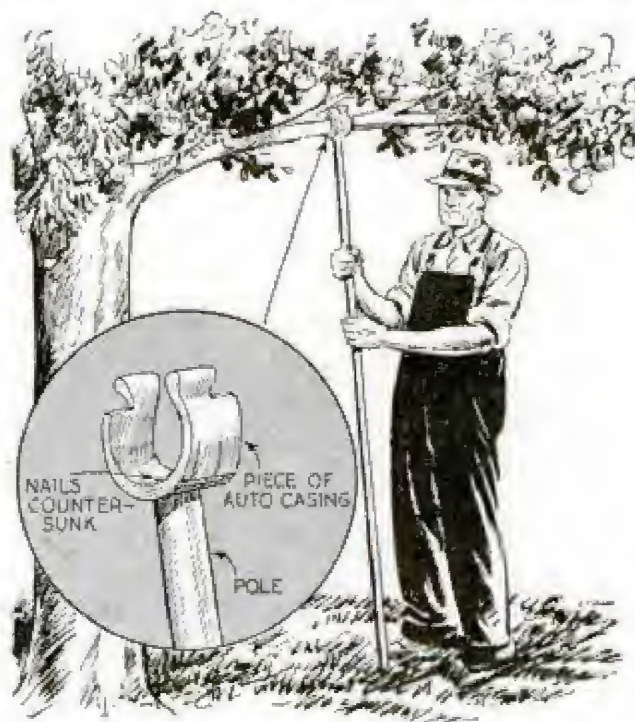
Non-Slip Limb Support on Fruit Tree Is Locked in Place

When sections of auto casing are nailed to the ends of poles to support heavily laden branches of fruit trees, there is danger that the support may be dislodged in a high wind. To avoid this, cut the casing sections in narrow strips and notch them so that they can be locked around the limb. If the branch is lifted by the wind, the supporting pole will still remain in place.

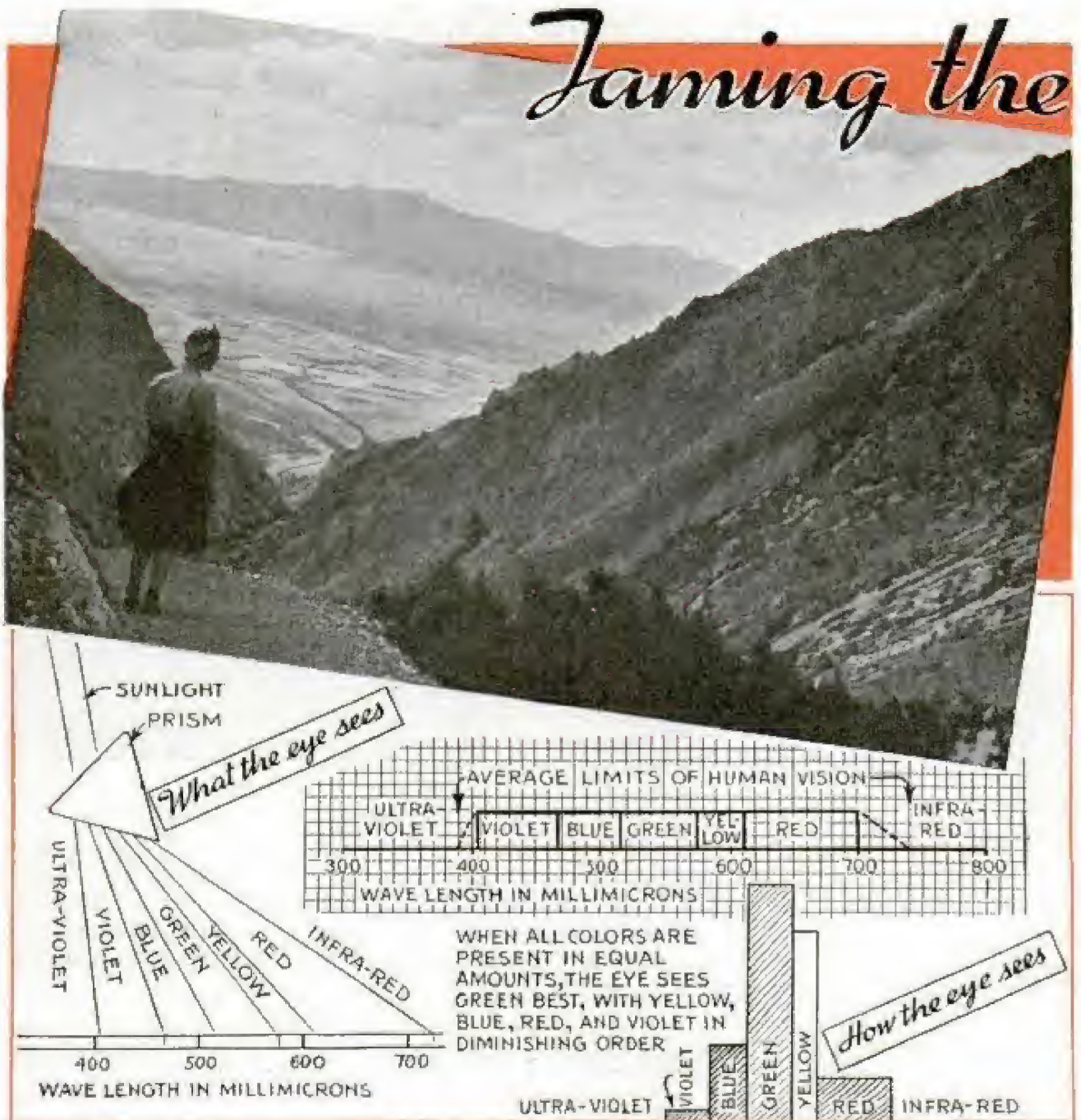
Broken Key Extracted from Lock with Jig-Saw Blade

If you break off a key in a lock, run an old jig-saw blade into the cylinder alongside of the broken piece and twist it so the teeth will bite into the key. Pulling on the blade while in this position usually will remove the broken piece.

—Julius Miller, New York.



Fanning the



Above: When the portion of a photo showing great distance occupies a relatively small part of the picture's total area, atmospheric haze should be allowed to show, for in black-and-white pictures, distance can be portrayed in no other way. In color photographs, distance is recorded as a deepening tone of blue, as it is in nature

HOW can you dim the sun's light—or brighten it? How can you make shadows more prominent to give roundness and size to an object? How can you push aside the veil of haze that almost conceals the view? These problems of the photographer are solved very easily by the correct use of color filters placed in front of the camera lens. Only by their use can the photographer reproduce the things he sees, and some of the things he can't see, but are there for the camera to record.

Sunlight is a mixture of many colors (see diagrams above). For simplicity we will recognize five—violet, blue, green, yellow,

and red. When all of these are present in about equal proportions, the eye recognizes the combination as white light, or light in which no particular color dominates or is absent.

Light waves are measured in millionths of a millimeter, or in units called millimicrons, abbreviated mu. The eye is sensitive to light waves measuring from about 410 mu. to about 740 mu. Waves shorter than 410 mu. are known as ultra-violet, and produce no sensation of light. Waves longer than 740 mu. are known as infra-red, and also are invisible. Human perception of color varies, it being poor for violet

WILD LIGHT WAVES

and red (the ends of the visible spectrum) and best for green. This has two important effects on your acceptance of photographs. First, it means that the brightest colors—those to which the eye is most sensitive—must be reproduced in the lightest tones of gray in the print. Second, it means that your eye is a very poor judge of what the camera can see, for you must remember that the eye is unable to see all the colors to which the negative emulsion is sensitive. The eye's inability to perceive violet to as high a degree as green is very important, for emulsions are often many times more sensitive to violet than they are to green. Although the average human eye perceives red to about 740 mu., most panchromatic emulsions are insensitive to red longer than about 680



Upper photo was taken when sky was cloudless. An F (deep red) filter was used to darken the sky and produce contrast between it and the white walls of the buildings. As the red filter eliminated blue skylight from the shadows, the buildings and statue are made more prominent. Lower photo was made by infra-red light on infra-red film through an A (red) filter. As no infra-red reflects from blue sky, shadows are dead black. The cliff in the foreground was in shadow, as were portions of the Grand Mesa, 30 miles away. Unusual effects like this result when blue skylight is eliminated entirely



mu. In this article it is assumed that a modern panchromatic (all-color sensitive) film is used.

Outdoor scenes are lighted by two entirely different kinds of light, and you can choose which one will be allowed to dominate in your picture, depending upon the effect desired. These two sources are the sun and the blue sky. The sun is the original source of all our light, but to the photographer the blue skylight is equally

important. While sunlight is considered as white light, the colors comprising it are not present in equal amounts. Yellow and green are most abundant, with red and blue next, and violet least. Blue skylight is different; violet is most abundant, with blue almost equally so. There is far less green, still less yellow, and almost no red. See diagram on page 132.

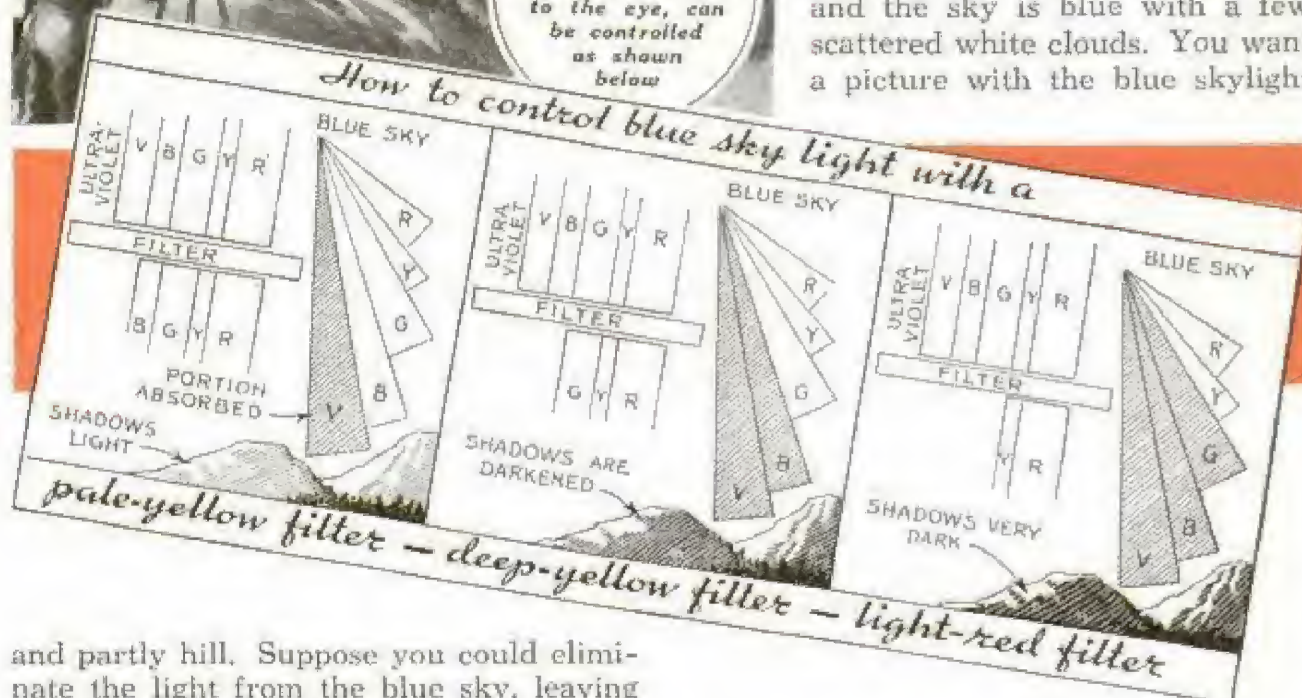
Suppose that your camera is trained on a scene of mixed trees, rocks, partly valley

WHAT YOU CAN DO WITH CAMERA FILTERS —



Trunks are visible clear across, and bark has lost its texture, for there are no shadows to give it roughness. Even the trees have lost their height for lack of shadow. There is a blue haze in the air that was not apparent in sunlight. The general impression is one of flatness. Things are dull and merge with one another. These are the two extremes of lighting, that of the sun and that of the blue sky.

Let us assume that it is mid-afternoon, and shadows are lengthening. The sun is bright, and the sky is blue with a few scattered white clouds. You want a picture with the blue skylight



and partly hill. Suppose you could eliminate the light from the blue sky, leaving only the bright sun. Where the direct rays of the sun are interrupted, there is total blackness. Shadows, in other words, are absolute. The sky is black, of course, and the sun appears like an intense searchlight at night. The size of rocks is exaggerated by immense shadows. Tree trunks are brightly illuminated on one side and dead black on the other. It is an unreal landscape, and objects are extremely bold. The effect is like a highly intensified moonlight.

Now suppose that you leave the blue sky and eliminate the sunlight. This is easier to imagine, for it exists in part when a cloud covers the sun. Now there are no shadows. Colors are less bright, especially reds and greens, and all colors have a colder look. Now it is difficult to tell the size of rocks, for there are no shadows to give clue to size. Trees are evenly illuminated.

subdued so that clouds will stand out and shadows will be a little darker. Take a pale yellow filter, such as Aero 1 or K 1. This stops most of the violet light, but has no effect on other colors. As the light illuminating shadows is blue skylight—and much of it is violet, the yellow filter produces the same effect that a partial darkening of the blue sky would produce. If the change with this filter is too slight, use an orange filter, such as G. The sky and shadows are now darker, for the orange filter stops violet and blue light, absorbing more of the blue skylight reflected from shadows and from the sky itself. For still more contrast, take a light red filter such as 23A, which absorbs violet, blue, and green, passing only yellow and red. As blue skylight contains little yellow and red, shadows ap-

SHUTTING OFF THE SUN — CUTTING THROUGH HAZE

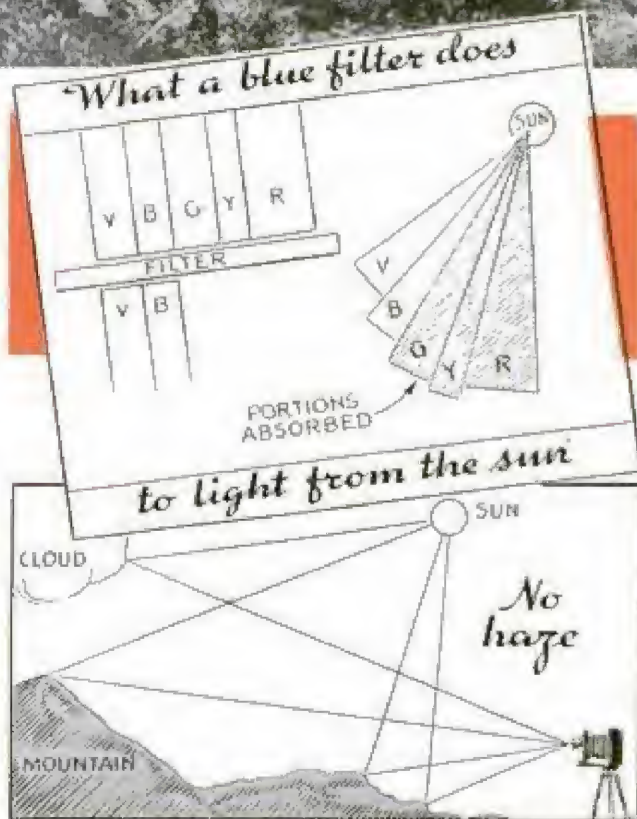


An Aero 1 (pale yellow) filter allowed all light except violet to reach the negative. The valley below is 6 miles distant. Haze in photo is greater than was seen by eye

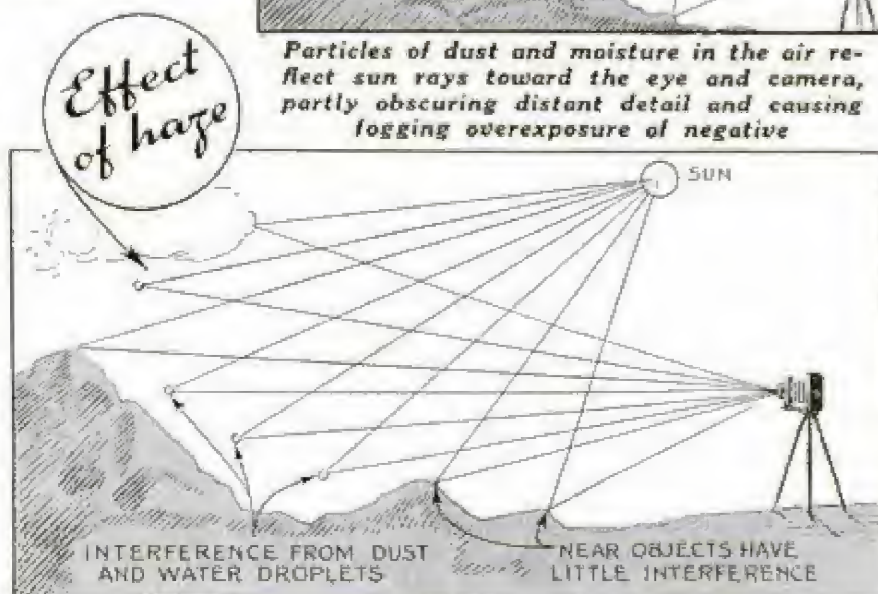
pear much darker. The sky becomes quite dark, and white clouds stand out. White clouds reflect all colors, naturally, and their yellow and red pass through this filter to the emulsion.

Since filters absorb light, each has a multiplying factor for each film, and this must be used in determining the correct exposure. Follow the film maker's recommendations. If green forms a large part of a picture, such as in big areas of grass and trees, the red filter may make this portion too dark in the print. This is because only a small amount of yellow and red is reflected from green. Therefore, use a G filter, which passes green. Sunlight may also be controlled. To reduce contrast, the photographer uses blue filters to absorb green, yellow, and red. Blue filters have little effect on shadows, but reduce the brilliance of sunlit portions, and also increase haze.

Haze presents a difficult problem to the photographer. It is composed of stray light waves reflected from particles of dust and water vapor in the air, and at times may hide distant landscapes



Particles of dust and moisture in the air reflect sun rays toward the eye and camera, partly obscuring distant detail and causing fogging overexposure of negative





completely. Violet and blue predominate in haze and methods used to reduce blue skylight also reduce haze. The Aero 1 filter has its greatest use in haze cutting. With most emulsions it requires but a 25-per-cent increase in exposure. Since haze

visible light is excluded and the photograph made with infra-red light waves on a special infra-red film through a G or a red filter. Infra-red film is now available in many sizes and some surprising effects can be obtained by using it.

has the same color composition as blue sky, the G filter will give greater penetration than the Aero 1, due to the absorption of blue light waves in addition to the violet absorbed by the paler filters. The 23A absorbs green in addition to violet and blue and gives still better penetration. The most complete penetration of haze occurs when all

How You Can Raise "Miracle" Plants

A revolutionary discovery in gardening



Here is an amazing booklet telling in simple language exactly how you can take advantage of this latest scientific advance and raise better, larger, yes giant plants and flowers at a cost of only a few cents by mixing your own vitamin B₁ solution. Astonish your friends. Roses have grown to three times the ordinary size and other plants in proportion. This method works like magic and produces unbelievable results. In addition, this booklet explains soilless plant culture, the care of your lawn and tells how to make garden furniture. Send 25 cents for this booklet and get complete information.

POPULAR MECHANICS PRESS, Box 27, 200 East Ontario Street, CHICAGO



IMPROVED *Sight and Sound* RECEIVER

LARGER and more detailed television pictures in sight and sound receivers for the home are claimed by the designer of the cathode-ray tubes and console set illustrated. The large tube is a 20-in. type which produces a picture approximately 11½ by 14½ in. when installed for direct viewing as shown below; the smaller tube is a 14-in. type.

Both of these tubes are equipped with an intensifier feature for producing brighter images with given



*Alfred B. Du Mont Laboratories, Inc.,
2 main St. Passaic, N.J.*



operating voltages. They also include a higher persistence screen which is said to make it possible to use lower frame frequencies without flicker. The special "Du Mont" fluorescent salts screen in the end of the tube is claimed to hold the image for a fraction of a second, instead of the usual instantaneous response and extinction, thereby eliminating the appreciable black interval between successive images which is the cause of noticeable flicker. Laboratory model demonstrations show images with frame frequencies of only 15 per second and with definition up to 625 lines per image. The orange-white flicker-reducing screen material used in the tube produces a vivid orange or golden screen color which probably may be altered to provide whites if more desirable. When the golden persistence-screen tube is employed, a rock-steady image is obtained whenever a "still" picture is picked up.

Beginner's

MIGHTY MIDGET



WITH distance-getting ability and volume all out of proportion to its size, this one-tube short-wave set takes full advantage of a greatly improved battery tube, the 1D8-GT. Thanks to the efficiency of the new multi-unit tube, this compact little short-waver will run rings around the two-tube battery sets of a year or so ago. Twenty-meter phone stations roll in with headphone volume at times actually uncomfortable, and there is plenty of "sock" even on weak foreign stations.

The power pack consists of a single 45-volt portable type "B"-battery. Two 1½-volt flashlight batteries serve as "A" supply, and the 4½-volt "C"-battery is made up of three 1½-volt "penlight"-type cells wired in series. These batteries are all taped together in the compact portable unit illustrated in Fig. 1 and photo (A). Battery drain is very low, and six months of intermittent service

should be possible with the set of batteries shown.

Complete panel and base details are given; both are cut from soft aluminum sheet, and the base is shaped over pieces of wood clamped in a vise, after all holes are drilled. A simplified

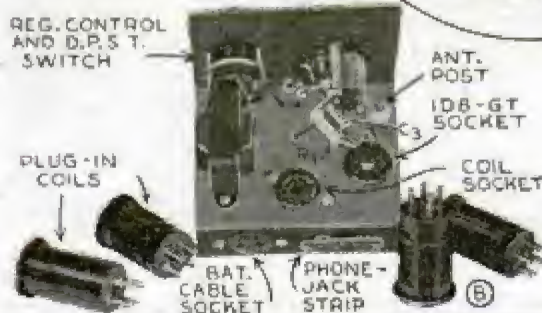
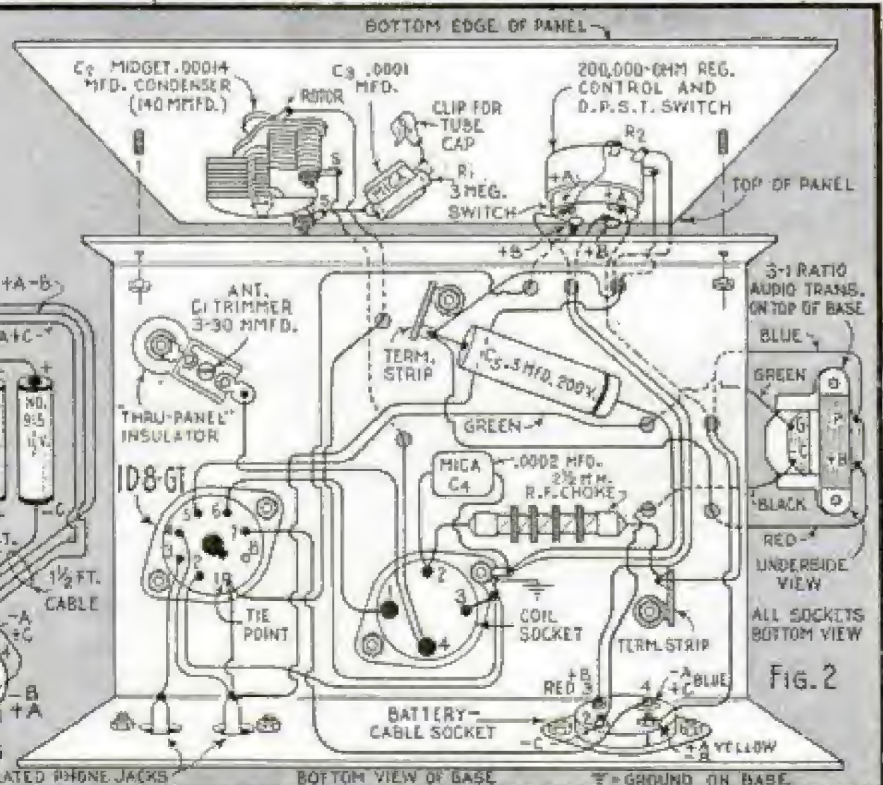
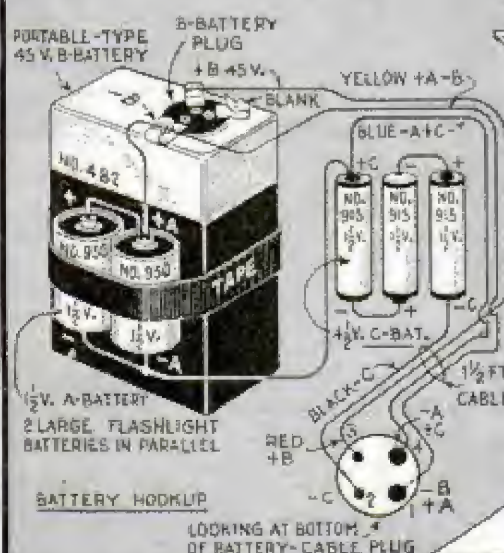


Fig. 1

NOTE—3 PENLIGHT-TYPE FLASHLIGHT BATTERIES IN SERIES FOR 4½-V. C-BATTERY

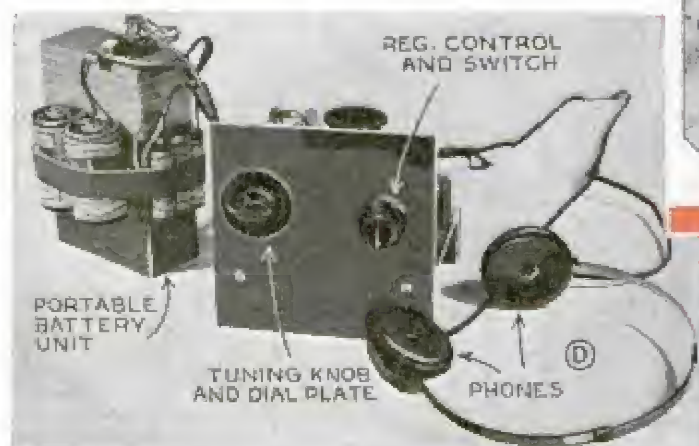
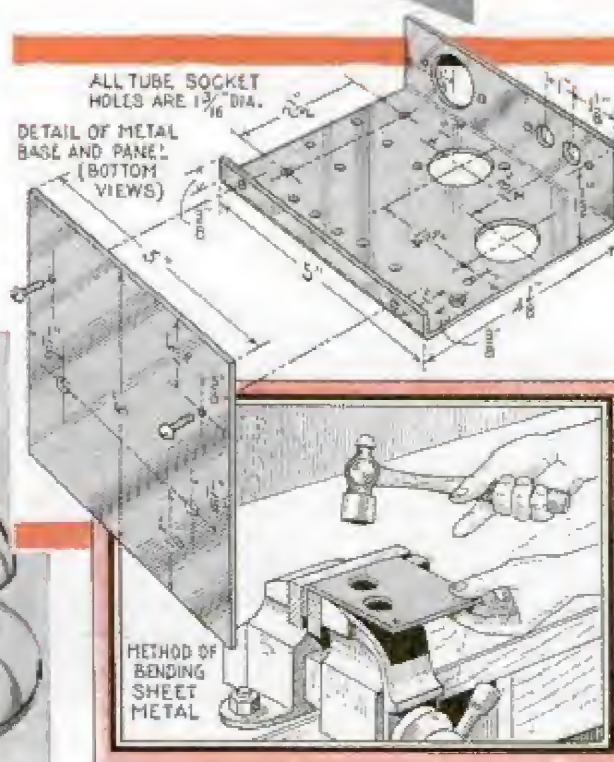
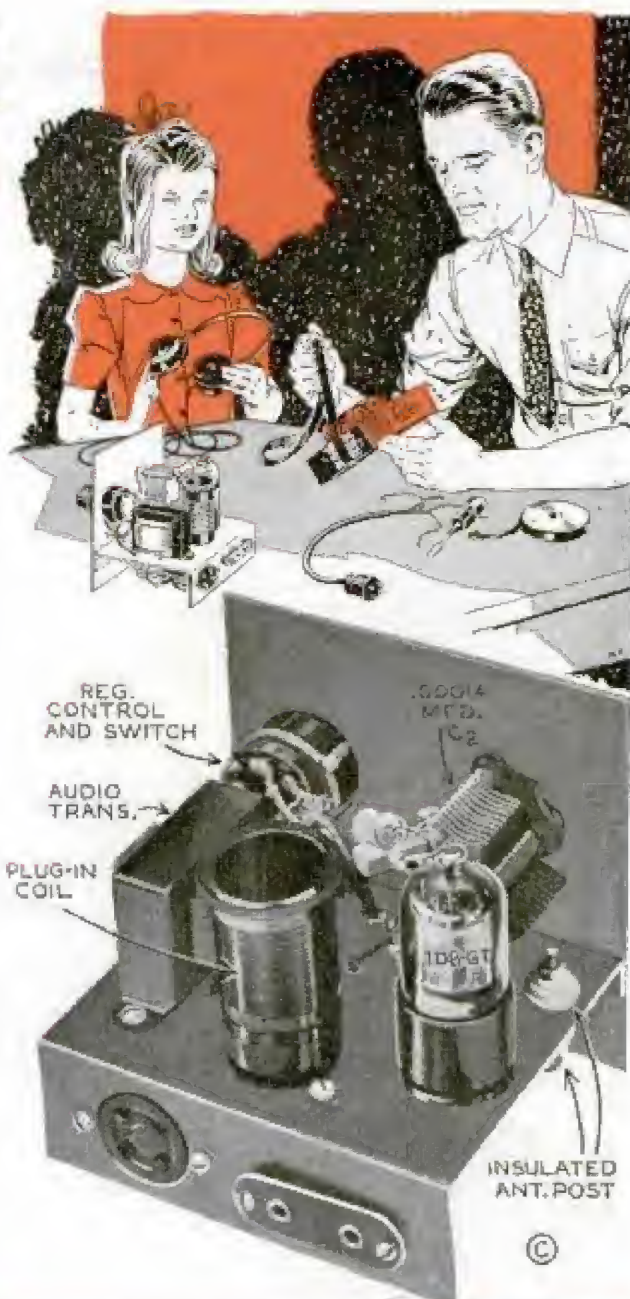


ONE-TUBER *for short waves*

wiring diagram showing every connection clearly indicated, appears in Fig. 2. When wiring the set keep all leads as short as possible and make well-soldered connections with rosin-core solder. Note that all soldered common ground connections under the base are made to soldering lugs placed under the coil-socket mounting screw. Do not attempt to solder to the aluminum base or panel. The schematic circuit diagram is given in Fig. 3; photos (B), (C), (D) and (E) show various views of the completed receiver.

It will be noted that the regeneration control (R_2) and the double-pole, single-throw switch are combined in one unit. This switch cuts off both the "A" and "B"-battery supply when the set is not in use. It is highly important that the switch terminals be connected correctly. If you are in doubt about these connections on your switch unit, you can check the terminals before wiring by using a small flashlight bulb in series with a $1\frac{1}{2}$ -volt dry cell. All battery leads within the set terminate at the 4-prong socket mounted on the rear of the chassis base. Any standard set of four 4-prong 2-winding short-wave coils can be employed; those used in the model were ICA No. 1421B, covering from $9\frac{1}{2}$ to 217 meters. Some modification of the small (tickler) windings may be necessary to obtain regeneration over the entire dial. In the original set the 13-22 meter coil had to have a larger tickler, the 4-turn coil being increased to 7 turns of No. 30 enameled

(Continued to page 134A)



Volume Expander Unit for P.A. Sound System



NO CRITICAL adjustments or tricky connections are necessary to use this compact, self-powered volume-expander unit to improve the tone quality of a phono amplifier. Although designed for advanced experimenters it is not difficult to build and only a few inexpensive standard parts are required.

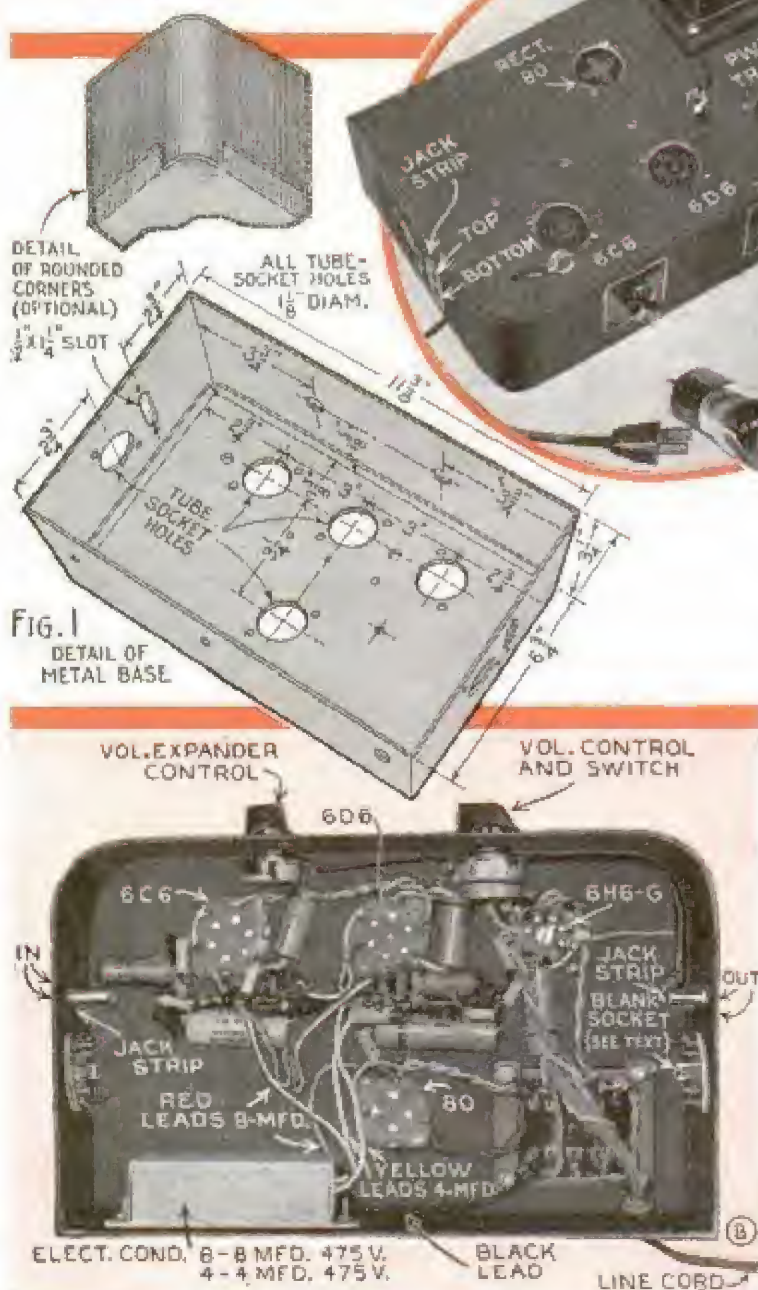
A volume expander performs a very important function in an audio amplifier, and is included only in high-priced audio systems. It is designed to recreate the original tonal realism of phonograph recordings. When recordings are made, it is necessary to reduce the louder passages

and to increase the level of the softer passages to avoid high surface noise and over-cutting into adjacent grooves. This results in a reduction of contrast and brilliance in the recording. To recreate the original rendition properly, the volume expander automatically builds up these values to their true volume relationship, maintaining correct balance between loud and soft passages

of the original recording, just as produced by the artists.

All parts are mounted on a simple sheet-metal base, details of which are given in Fig. 1. Rounded corners are suggested, and a coat of black crackle lacquer is applied after all holes are drilled. Top and underside views are shown in photos A and B. All parts values appear in the schematic circuit diagram Fig. 2, and the actual arrangement is clearly shown in the underside photo. The power transformer is an ordinary half-shell type used to power any standard 4-tube set using 6.3-volt tubes; primary 115-v. 50-60 cycles; secondary windings "B" 650 volts at 40 ma. center tapped; "A" 6.3 volts at 1.6 amp.; 5 volts at 2 amp. Other parts required will be the

(Continued to page 136A)



Practical RADIO SUGGESTIONS

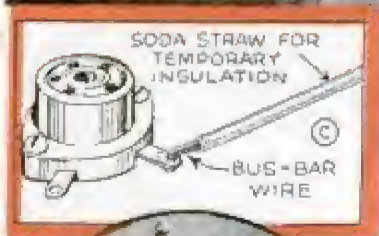


↑ CONDUCTOR ↑ CO-AXIAL CABLE ↑ INSULATING BEADS ↑ METAL BRAID SHIELD ↑ OUTER COVERING

(A) Co-axial cable provides a highly efficient means for connecting the antenna to any receiver. It passes a wide range of frequencies without noise pickup and the usual prohibitive losses, especially in the short-wave broadcast, television and frequency-modulation bands. Flexible and easily installed, the type shown consists of a center conductor isolated by means of low-loss "Amphenol" insulating beads covered with a metal braid shield; the outer covering is waterproof insulating material.



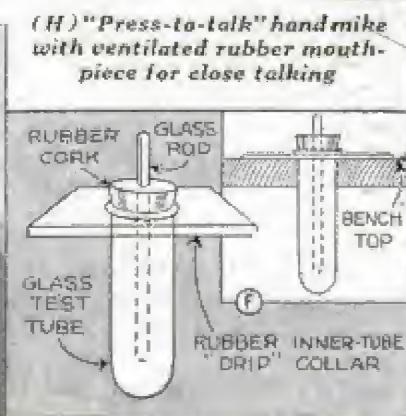
CO-AXIAL CABLE APPLICATIONS



(B) Miniature 1.4-volt tubes now enable experimenters to build really compact portable receiving sets, hearing aids and similar lightweight radio equipment. (C) An ordinary soda straw used as a temporary substitute for "spaghetti" insulation in experimental hookups. (D) Telescoping low-loss cylinder-type neutralizing condenser designed so that inner cylinder fits over supporting "Isolantite" insulator, eliminating external supports. These are available in popular capacity ranges and voltage ratings.



(E) Handy screw container for radio workbench, made from discarded tube bases screwed to a disk of wood. A stand-off insulator forms handle. (F) Test tube serves as sunken bench container for coil dope. (G) Illuminated call letters; kit includes transparent letters and numbers for any combination in escutcheon. Metal case houses 110-volt candelabra bulb.



*Crowe Name Plate Mfg Co
3701 N. Ravenswood Chicago*

*American Phenolic Corp
1250 W. Van Buren
Chicago
James Muller Co. Malden Mass
Universal Co. Hollywood Calif
Universal Co. Hollywood Calif*

One-Unit Portable Sound System



Amplifier, loud speaker, microphone and lighted tilt-top reading table are all combined in this completely portable one-unit system. The unit is ready for use when plugged into any a.c. outlet. Outstanding features include: 14 watts of usable power output; inverse feedback; phono input connection; separate volume controls in mixer circuit; bass-treble tone control; speaker selector and provision for additional speakers. Controls are on rear panel.

Precision Frequency Monitor



To facilitate zero-beat adjustments, a tuning eye is employed in this frequency monitor which is designed for accurately checking in any three bands of frequencies from 1.5 to 60 megacycles. A 100-kilo-cycle crystal is

used as a secondary standard. Very stable electron-coupled oscillators are employed to cover a band of frequencies from 50 to 1,000 kilocycles wide, the required frequencies being included in these narrow bands. When exact zero beat is obtained, the tuning eye opens. Either side of zero beat, the eye "flutters" at the beat-note rate; phones are used for aural checking.

Six-Tube Radio in Davenport

Designed for convenience and conservation of space in small apartments, this unusual combination of radio receiver and davenport is offered by a furniture manufacturer as a solution of the problem. The panel and speaker grille harmonize with the frame pattern. Six tubes are employed in the set which will operate either on A.C. or D.C. current and has a built-in antenna.



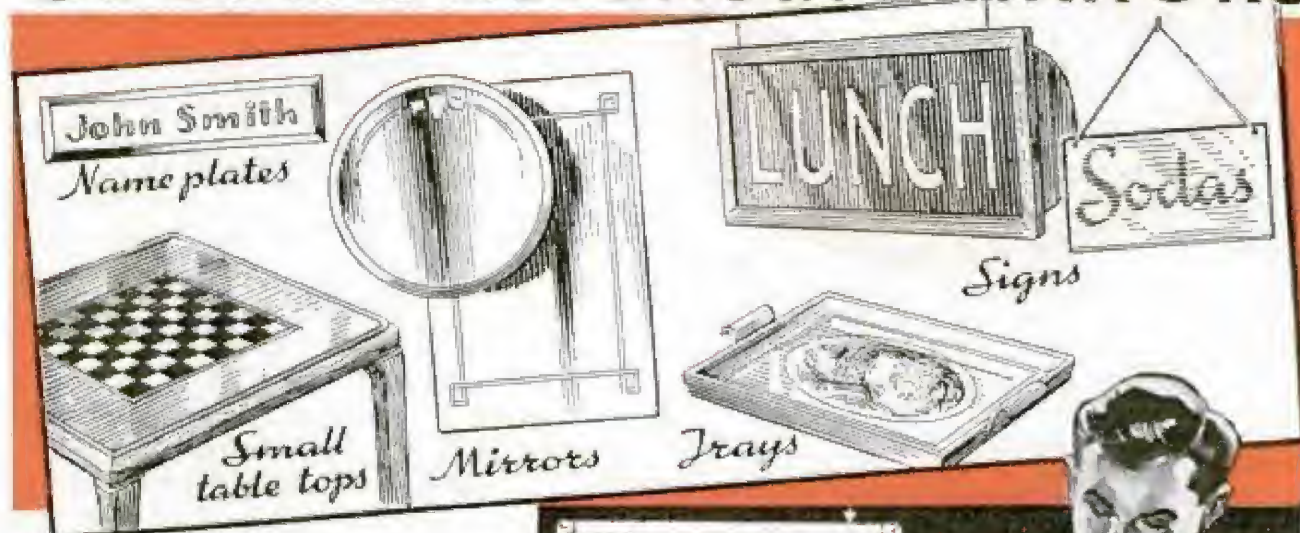
Blueprints covering radio construction articles in this and past issues are available for 25 cents each. Original material lists, with names of manufacturers and dealers, can be obtained from our Radio Department upon receipt of postage.

NEXT MONTH—How to Build a Capacity-Operated Vacuum-Tube Switch. Only a few simple and inexpensive radio parts are required to assemble this sensitive and useful alarm relay. Adjusted with a single control, it operates on any 110-volt a.c. line to protect home and property. Also—**A Loop-Type Phono Oscillator**



SHOP NOTES

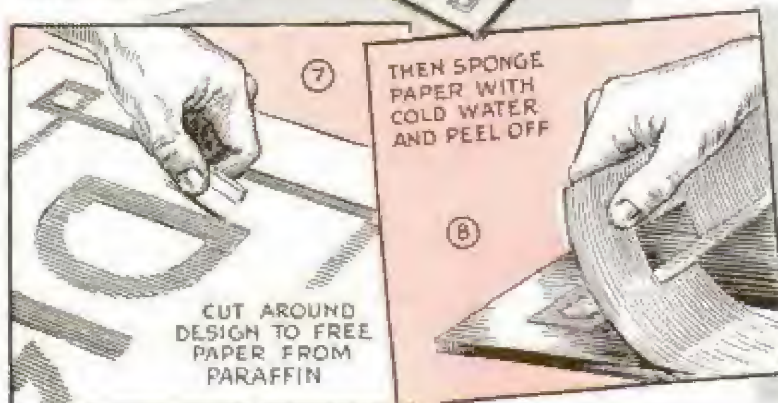
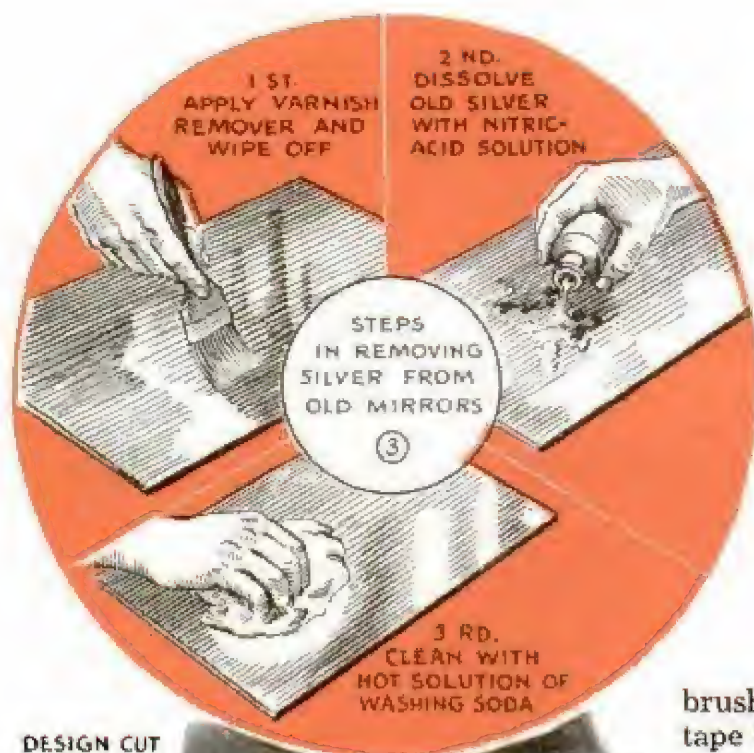
COLOR DESIGNS *in* MIRRORS



BY PARTLY silvering and partly coloring glass surfaces, you can make attention-getting advertising signs, attractive trays and table tops and numerous other articles. Cleaning and silvering glass are done in a tray formed by folding up the edges of a piece of sheet iron, Figs. 1 and 2. The tray is coated with asphaltum paint and the glass to be silvered is supported face down on four hardwood wedges so that it will be level, which is the case when water will not run off.

The glass is cleaned thoroughly with a hot solution of washing soda, 1 lb., in water, 1 gal. This is rinsed off with water, followed by a cleaning with a solution of C.P. (chemically pure) nitric acid, 1 fl. oz., in distilled water, 6 fl. oz. Be careful not to get nitric acid on clothes or skin—if this is done inadvertently, immediately wash off with a copious supply of water. After rinsing off

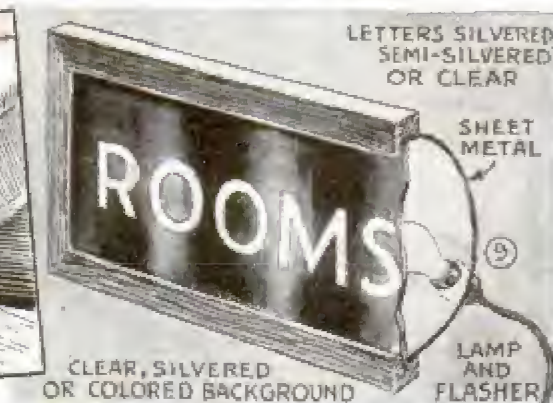


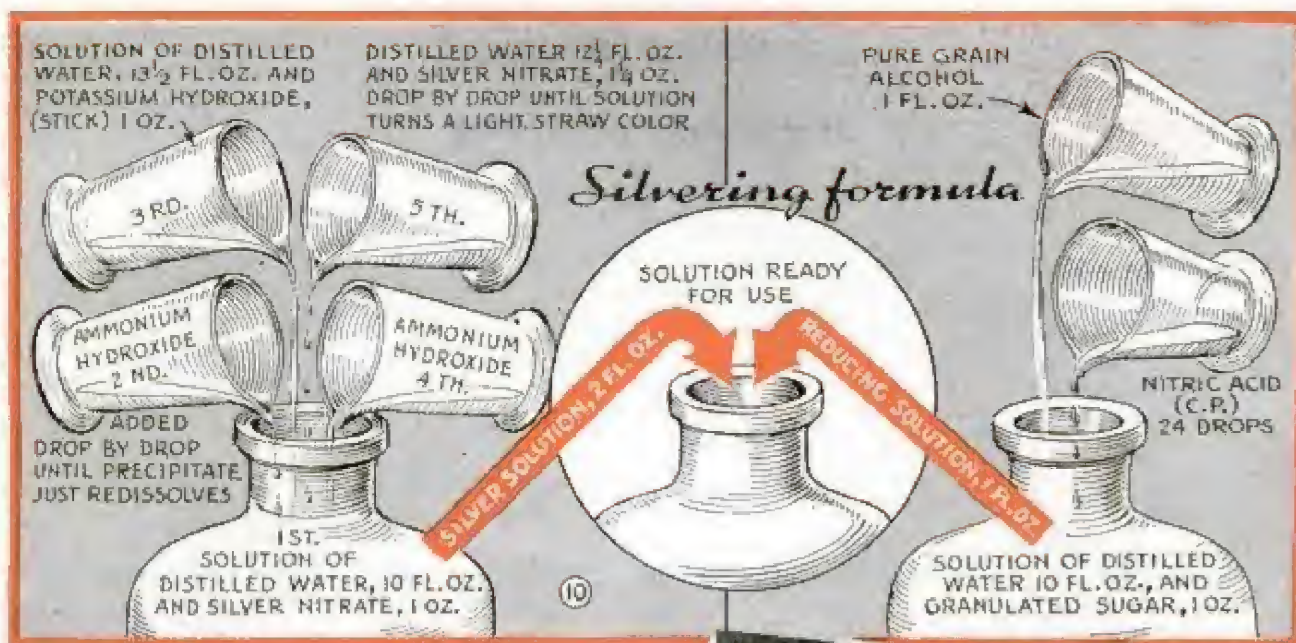


the nitric-acid solution with distilled water, the glass is allowed to dry under a cover to keep away as much dust as possible. Areas to be colored are covered with melted paraffin as in Fig. 6 so that the silvering solution will not touch the glass. In masking off portions of a design, the pattern is cut out of gummed paper tape and is applied to the glass in reverse. Figs. 4 and 6 show such a mask where the lettering is to be silvered and the background colored, while Fig. 5 shows masks to cover the letter spaces, where the background is to be silvered and the letters colored. While the gum of the tape is still moist, paraffin is

brushed on. After this has hardened, the tape is cut to free it from the paraffin, Fig. 7, and it is soaked off in cold water, all traces of the gum being removed carefully without damaging the paraffin. You can use a sponge as in Fig. 8. Distilled water is poured on the glass next; if it wets the entire surface the glass is clean, but if water flows away from parts the glass must be re-cleaned, the soda solution being used cold to prevent melting the paraffin. After cleaning, a solution of stannous chloride, 1 dram, in distilled water, 1 gal., is flowed onto the glass and is allowed to remain there until you are ready to do the silvering. When you want to resilver old mirrors remove the coating as shown in Fig. 3 and then proceed in the manner already described.

Fig. 10 shows the silvering solution, which consists of a separate silver solution and a reducing solution, mixed together just before use. The silver solution cannot be stored and any surplus should be discarded at once, as dangerous explosive compounds may be formed on long stand-





ing. The reducing solution, however, can be stored. To make up the silver solution, dissolve C.P. or reagent grade silver nitrate, 1 oz., in distilled water, 10 fl. oz. Only C.P. or reagent grade chemicals and distilled water should be used. When this has dissolved add C.P. ammonium hydroxide—not household ammonia—drop by drop with a medicine dropper, shaking after each addition until the precipitate first formed just redissolves. Next, add a solution made by dissolving C.P. potassium hydroxide (sticks or pellets), 1 oz., in distilled water, 13½ oz. This will cause a heavy precipitate to form. Again ammonium hydroxide is added by drops until this redissolves. Finally, add enough of a solution consisting of silver nitrate, 1¼ oz., in distilled water, 12¼ oz., so that the final solution turns to a light straw color. The reducing solution is made by dissolving granulated sugar, 1 oz., in distilled water, 10 fl. oz. To this pure grain alcohol (not denatured), 1 fl. oz., and C.P. nitric acid, 24 drops, are added. The solution is heated to boiling and allowed to cool before use.

When ready for silvering, rinse away the stannous-chloride solution on the glass, using distilled water. Two parts of the silver solution and one part of the reducing solution are mixed, and the resulting solution is immediately flowed on the glass. This is allowed to stand until the silver has all deposited, which will take about 10 minutes. Then the surface is rinsed with distilled water and allowed to dry. Do not use forced drying methods and do not touch the silver. The next step is to apply



lacquer or varnish to the silvered surface with a soft brush. When dry, the paraffin on the rest of the glass is removed with hot water.

Unsilvered areas can be left bare or are painted. Ready-gummed cellulose tape in bright colors may be used for borders as in Fig. 11. Or, the unsilvered areas can be given a very thin coat of silver so that they are reflecting or transparent, depending on whether or not there is a light behind them. See Fig. 9. To do this silvering, the glass is cleaned as before and it is placed face down in the tray with a sheet of printed matter underneath. The silvering solution is applied and allowed to react until the printing is just barely visible. Then the solution is immediately washed off and, when dry, the surface is given a coat of clear lacquer.

Painting Round Spots

When it is necessary to paint a number of round spots on work, use a short dowel with a piece of thick felt glued to one end. The felt will absorb the paint so that it will not smear when applied to the work.

Guide Lines to Letter Window Drawn on Roller Shade



As an aid in lettering daily special sales on his show window, one grocer ruled guide lines on a cheap window shade and hung this inside the window as shown. When not in use, the shade is rolled up.

Exploring Coil Locates Short in Concealed Wiring

When a short circuit at some unknown point in a length of concealed wiring of an a.c. circuit cannot be located, one electrician finds it by means of this simple tester. By listening to the earphone and holding the exploring coil of the tester parallel to the direction in which the concealed wires run, and as close to them as possible, a



distinct hum is heard. As the coil is moved along under the wires, the hum will cease when the tester is in proximity to the short circuit. To make the tester, wind some bell wire on a 3-in. tube until you have from 25 to 50 turns. The ends of the coil are connected to an earphone and a suitable handle is provided. While such a test is being made, a 25-watt lamp is substituted temporarily for the blown fuse in the line.

—Arnold J. Shear, Fulton, Ill.

Shipping Clerk Keeps Paper Clips on His Key Ring

A shipping clerk found that a key ring like the one shown kept paper clips conveniently in his pocket. When a clip was needed, he just opened the ring and slipped one off.



Darning Needle Applies Oil to Small Parts

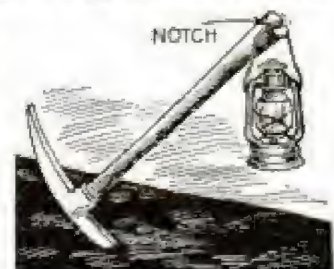


A handy applicator for oiling small mechanisms can be made by breaking off the blunt end of a darning needle, leaving half of the eye to form an open notch as shown. The point-

ed end of the needle may then be inserted in the cork of the oil bottle.

Pick Handle Holds Signal Lantern

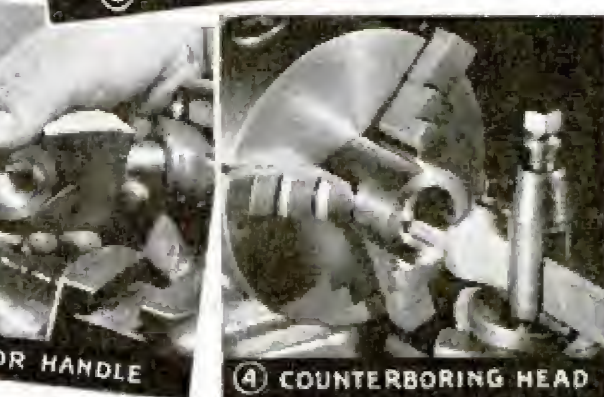
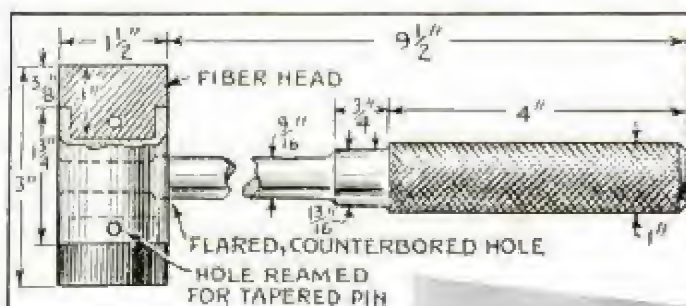
To eliminate searching for a rod or pole from which to suspend a signal lantern, one contractor sawed a notch in the end of a pick handle to receive the lantern bail. With the point of the pick driven into the ground, the lantern could be suspended from the notched handle in safety.



Metal SHOP MALLET

has fiber-faced head

ESPECIALLY useful for driving lathe mandrels, turning dogs and many other jobs likely to be marred with a regular hammer, this mallet, Fig. 1, is faced with fiber disks, which are easily renewed, as they are held in place with tapered pins. The job is one for your metal-turning lathe. The handle is first knurled, Fig. 2, then turned to size, Fig. 3, according to the dimensions given in the drawing below. Next you counterbore the head, Fig. 4, and drill the hole to accommodate the handle, Fig. 5. The 1-in. thick fiber disks are rabbeted to fit snugly in the recessed ends of the head, and are clamped in place while drilling and reaming holes for the tapered pins which are cut off flush, Fig. 6.



Wrench and Bench Vise Hold Pipe While Threading It



If a pipe vise isn't available, pipe can be held for threading in an emergency by using a bench vise and a wrench as shown. The vise holds the pipe in a horizontal position, and the wrench, with its handle resting against the bench edge, keeps the pipe from turning.

Hand Guards for Grape Pickers



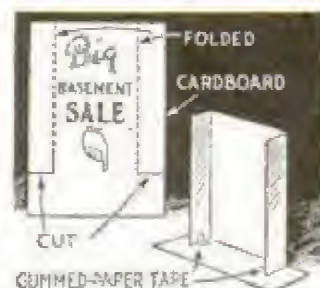
Relying mostly on inexperienced, transient help during harvest time, a grape grower furnishes all pickers with hand guards, or mitts, as a safety measure. These are made from discarded inner tubes and snaps of the auto side-curtain type, the entire expense being that

of the snaps. As the knives used by the workers for cutting off the grapes are of the hook-point type made especially for severing the tough stems, an inexperienced

picker can easily injure his left hand or wrist seriously with the hooked edge, especially where the bunches are cut beneath the vines without entirely seeing them.—W. E. Dennison, Sacramento, Calif.

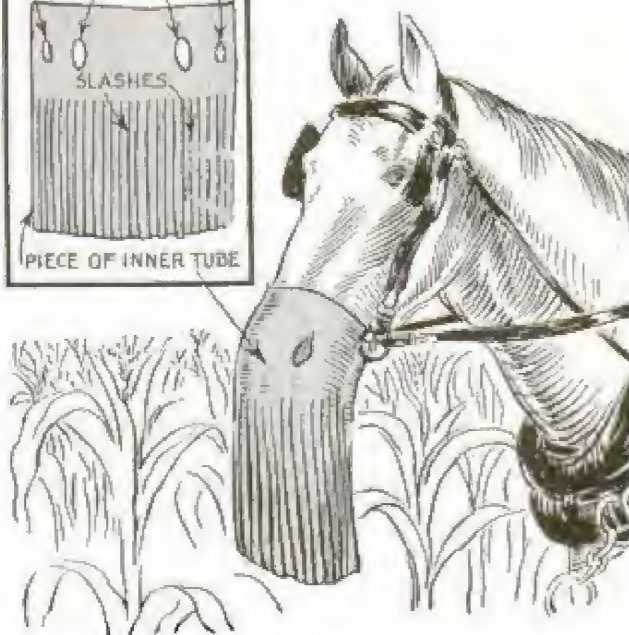
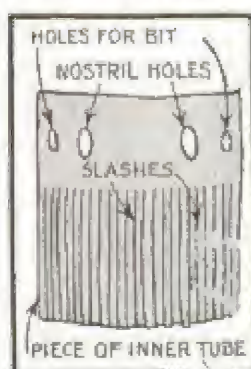
Display Card Is Self-Supporting

Large display cards may be made to stand alone on the floor or counter as shown. The card should be somewhat larger than the sign space required and should be cut and folded as indicated. A couple pieces of gummed tape will serve to hold the card folded so that it may be moved from place to place.



Rubber Nose Shield for Horses Working in Field

A simple guard that will help keep insects from bothering the nose of a horse working in a field, and also prevent the animal from constantly nibbling at growing crops, can be made from a piece of inner tube as indicated. The large holes cut in the rubber should coincide with the horse's nostrils so that its breathing will not be impeded. The guard will also tend to discourage a horse that has acquired the habit of nipping at another when they are hitched together.

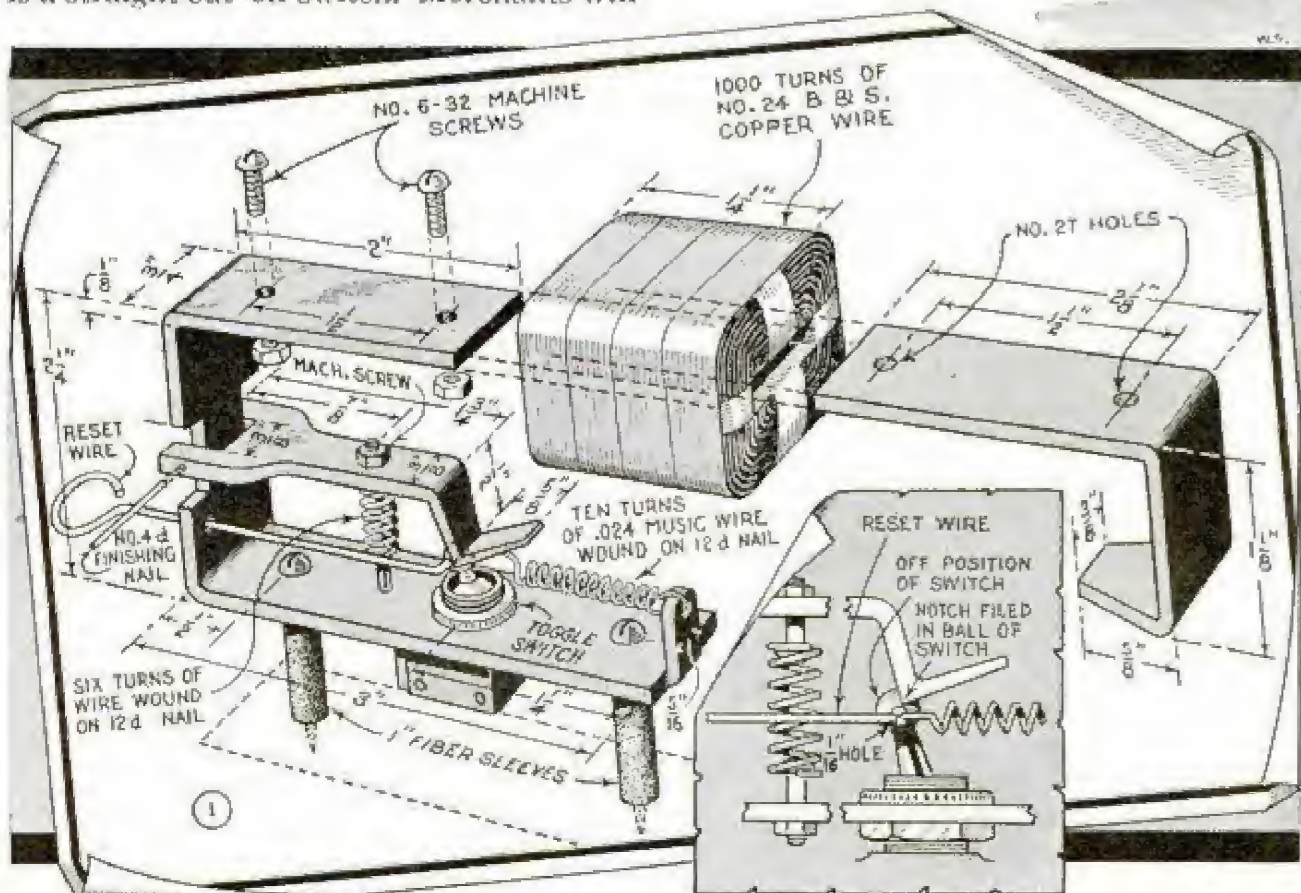


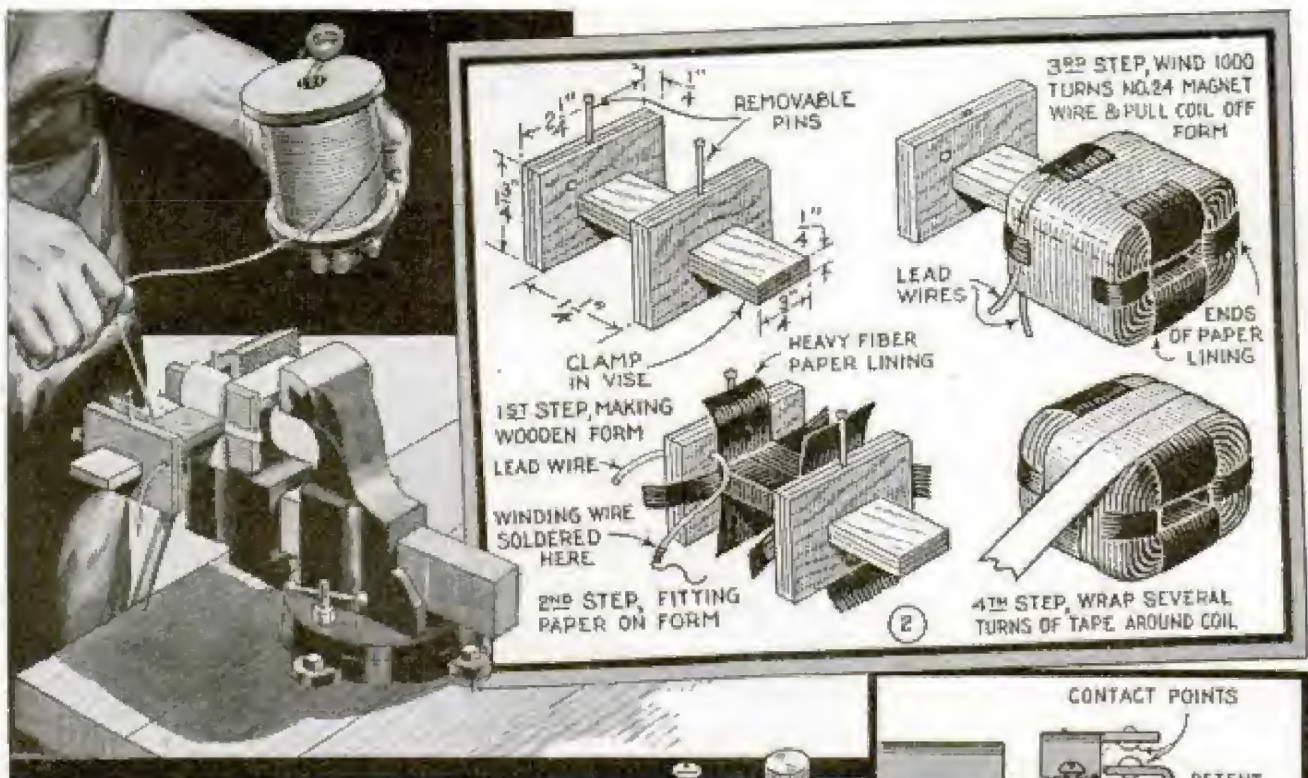
Converting Electric Clocks to TIME SWITCHES

By C. A. CROWLEY

DO YOU need a time switch to turn off lights or electrical appliances at a predetermined time when no one will be there to turn the switch by hand? Perhaps your problem is to turn one circuit off and another on at the same time, or after an elapse of time. By simply making a few alterations in one or two electric alarm clocks and making relays from some scrap iron and some copper wire, you can have these automatic servants to save your time and labor. In effect you are altering them to form time switches, which turn electric circuits on and off at any time for which the clocks are set.

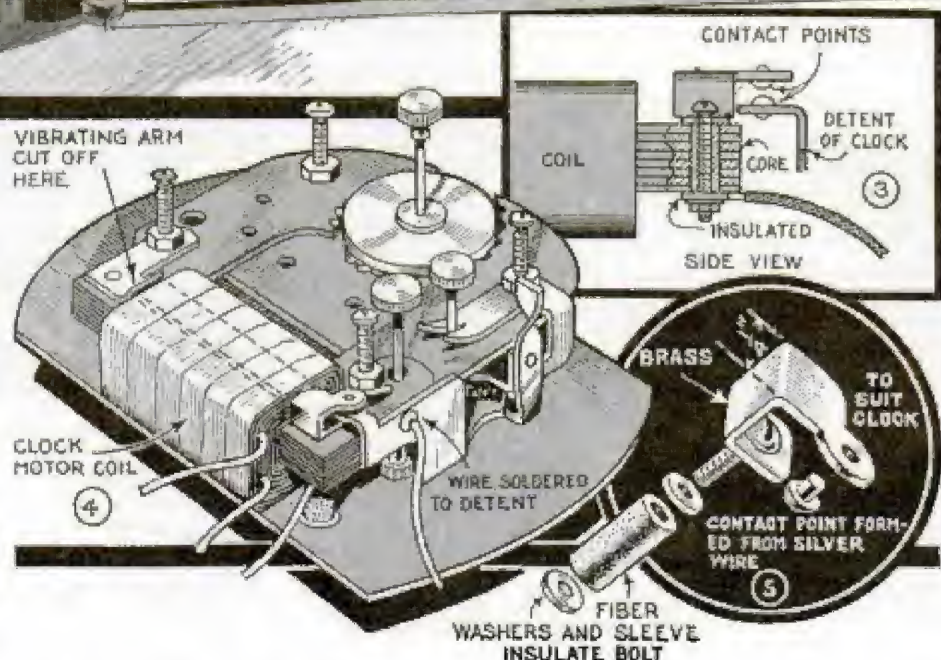
Three models: Three models of time switches will cover many needs. The relays used are the same but the circuit connections vary, as shown in the diagrams Figs. 7, 8 and 9. The arrangement in Fig. 7 is a straight cut-off switch. Merchants will





find it useful for shutting off display lights. Or, this arrangement is useful for turning off a radio, ventilating fan, outdoor lights and other appliances. A slight elaboration of the circuit, as shown in Fig. 8, enables one to turn one circuit off and another on at the same time, or either one of these functions separately. With this switch a radio can be turned on in the morning, or a solenoid-type water valve can be opened to start a sprinkler system, etc. The third model has two electric alarm clocks and two relays, Fig. 9. This one will turn a circuit on and then off after a lapse of time, such as turning hall and porch lights on early in an evening and off at a later time. As all of these time switches are designed to be portable and compact, they can be moved around wherever needed.

Making the relay: Fig. 1 shows the general assembly of the relay, and the parts comprising it. Flat iron $\frac{1}{8}$ in. thick is used for the frame, pole piece and armature. It is advisable to anneal the bends from a cherry-red heat to relieve the strains set up in them. This can be done over a gas stove or even in the furnace of your heating plant. Dress up the pieces with a file



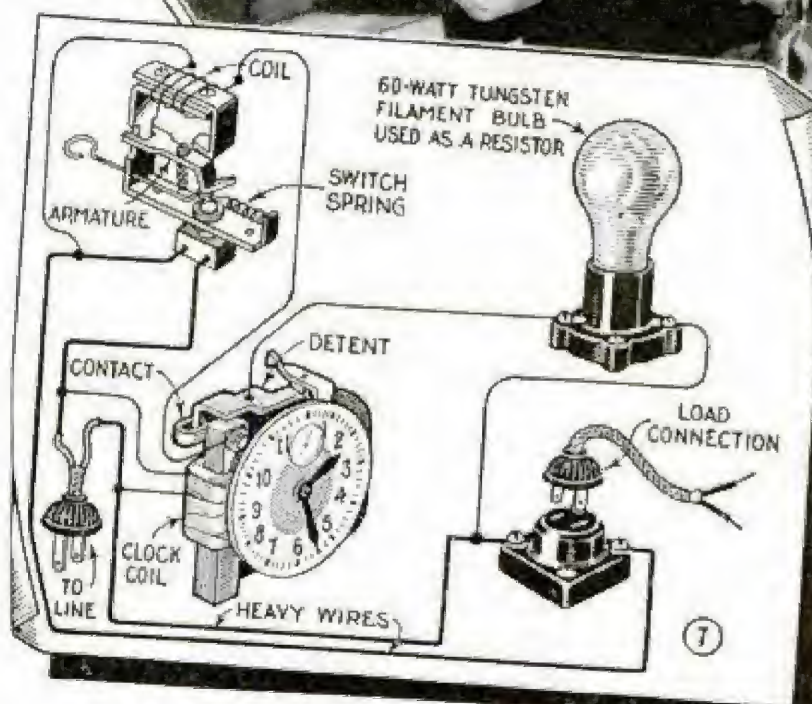
and drill the holes as indicated. When drilling the holes to fasten the pole piece to the frame, it is advisable to clamp them together and drill through both pieces at once to insure a perfect matching of these holes when the relay is assembled. Drill the hinge-pin holes in the frame and armature before notching them out to fit each other. Care must be used not to allow the holes to wander off center.

To wind the armature and switch springs, a small flat is filed on the side of the nail so that the end of the music wire can be clamped to it in the vise. Wind the turns as closely together as possible. No. 24-ga. music wire is used for making both springs. See Fig. 1. In notching up the ball tip of the toggle switch do not attempt to form it by hammering. Use a file, as the toggle is usually made of hard brass and is brittle.

The notch for the switch catch is filed on the side of the toggle that is held by the relay armature when the switch is in the on position. Details of winding the coil on a form are shown step by step in Fig. 2. It is not necessary to wind the coil in layers. Single cotton-covered magnet wire, No. 24, is satisfactory, but enameled or other insulated wire may be used.

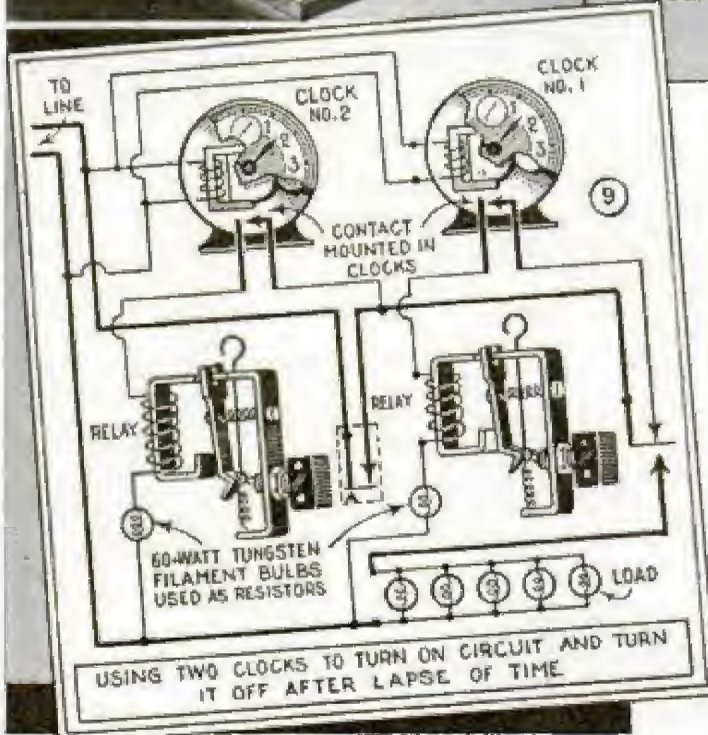
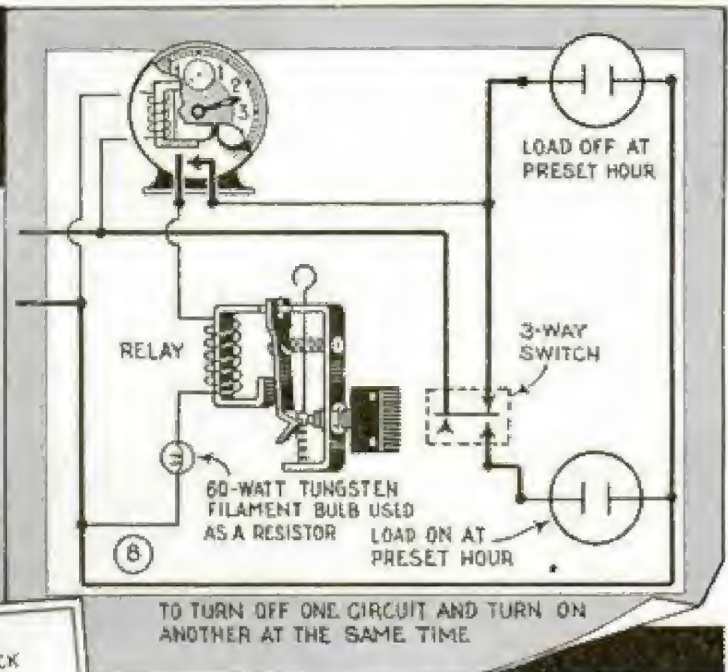
In assembling the relay, first place the mounting screws in their holes, then hinge the armature and mount the toggle switch. The armature or switch catch and the toggle switch usually have to be adjusted to each other. This can be accomplished by carefully bending the catch with a pair of pliers if necessary, and also by moving the switch up and down by means of the mounting nuts. A piece of stiff wire will serve as the reset catch when bent to shape. Slip the coil on the frame, insert the pole piece, and fasten the two together. Tighten the fastening screws securely to prevent the pole piece from chattering.

Modifying the clock: Alterations on the clock are the same for all the models and consist of installing a pair of electrical contacts in the alarm system. Where two clocks are used, the procedure is exactly the same for both clocks. The clocks do not need to be alike so long as they both have an alarm system. The alarm system of an electric clock is very simple. As shown in Fig. 4, a vibrator arm, which lies next to the motor coil, is riveted at one end to the laminated core of the clock and is held in place at the other end by a movable detent or catch, which releases the arm, allowing it to vibrate. The vibrating arm is cut off as indicated. A contact point on the detent is made by removing the detent, drilling a hole in it at the point shown, inserting a short piece of silver wire, (obtainable at jewelers) and riveting over the ends with a hammer. Use a hardwood block to back up the work while riveting the wire, to prevent excessive flattening of the contact on the other side. A second silver contact is mounted



in the same way on a piece of sheet brass cut to fit your particular clock. This contact must be electrically insulated from the rest of the works when mounting it on the laminated core as shown in Figs. 3 and 5. Then the lead wires are soldered in place. Bring these wires through the cord hole in the back cover plate and close up the clock. Cut off the clock cord about 3 in. outside of the cord hole. If, by chance, you have clocks already equipped with contacts, these may be used and this part of the work omitted by simply bringing out leads from them after disconnecting them from the rest of the clock works.

Mounting the parts, wiring and testing: If the clock has a wooden frame, the relay, the lamp receptacle and the load plug-in socket can be screwed to the top and sides.



Otherwise these parts and the clock are all mounted on a wooden base of suitable size. In wiring, do not use a wire size of less than No. 14 gauge where the lines on the diagram are heavy, but No. 20 gauge wire is sufficient for the lighter wiring. In all

cases, stranded wire is preferable to solid conductors.

Use a 60-watt lamp in the resistance receptacle, pull the reset back until the catch holds the switch, and plug the switch clock into the line. Do not touch anything until you have made a test to find the grounded side as in Fig. 6. This is done by touching one lead from a lamp to the metal back of the clock and the other lead to a water pipe or radiator valve to obtain a good electrical ground connection. If the lamp lights, reverse the cord plug used to connect the clock to an outlet. After this has been done, plug some convenient test load such as a desk lamp into the load receptacle. The lamp should now go off at any time to which the alarm is set. In Figs. 8 and 9, three-way switches are used. In the diagrams, connections are made to the switch as indicated in the dotted portion although the switch itself is shown attached to the relay without any connections.

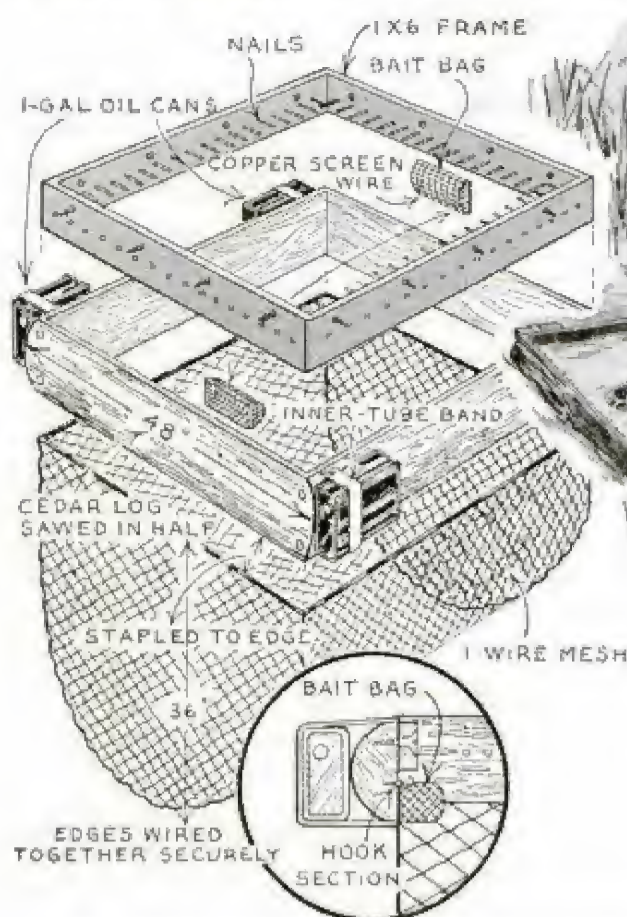
Advertising Sign for Barber Shops That Will Be Noticed

Practically everyone entering a barber shop will, sooner or later, sit in the barber's chair, where he will see numerous advertising signs, all appearing in reverse, as he views them in the mirror. To make an attractive sign that will read correctly as seen in the mirror, first make your sign in black opaque show-card colors, on white medium-weight bond paper. When this is dry, oil the paper with a light grade of

machine oil, wiping off the surplus thoroughly. This will make your paper translucent. Use it for a mask for a blueprint sign, making your blueprint in reverse. This will give you a neat sign with a blue background and white letters, printed in reverse. Hang it in a barber shop where it will be seen in the mirror, and it will never fail to attract attention and comment.

—Ned Belcher, Waterbury, Conn.

Pond Freed of Turtles with a Floating Trap

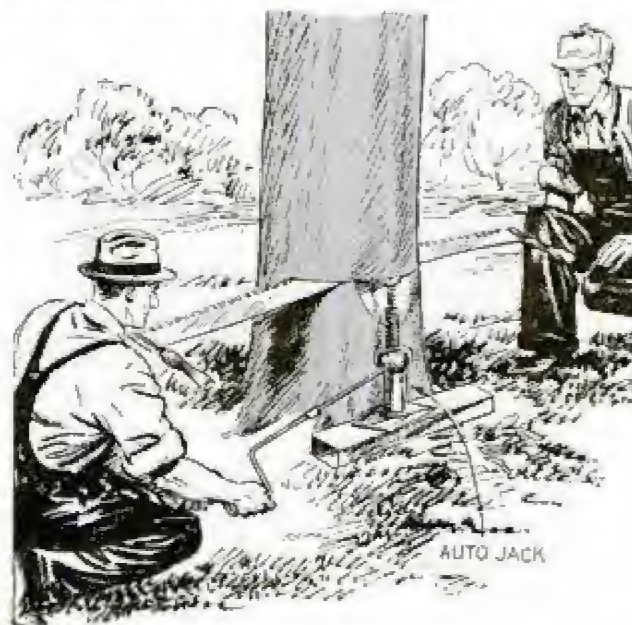


Poultrymen and farmers who raise geese and ducks and give them access to a pond or other small body of water, can reduce the loss of goslings and ducklings taken by turtles, if this trap is used to catch the turtles. Also, several of the traps located strategically in larger bodies of water that have been stocked with fish will aid in preventing loss of tiny fishes and spawn,

which are devoured in vast quantities by turtles. To assemble the trap, make a frame 4 ft. square from split logs, and to it tack 1-in. wire mesh so that it hangs baglike to a depth of 3 ft. Inside the log frame, attach a second one of 1 by 6-in. stock with nails projecting 2 or 3 in. inside it as indicated. The nails keep turtles from climbing out of the trap. Next make three or four pockets of copper screen wire to contain bait, which may be stale or decayed meat, and attach them to the frame with screw hooks as shown in the circular detail. To increase the buoyancy of the trap, attach 1-gal. cans, that are airtight, to each corner with strong rubber bands.

Automobile Jack Replaces Wedge While Felling Large Tree

If no wedges are available to prevent a tree from pinching the saw while felling it, an auto jack may serve the purpose. Simply saw into the tree trunk so that a section can be chipped out with an ax below the sawed cut to provide a place on which to rest the end of the jack as shown. As the saw goes deeper, frequent raising of the jack will open the cut and aid in felling the tree in the direction desired. Of course, an auto jack is only suitable for this purpose when a light wedging effect is required. Such a jack cannot be used to cause a large, leaning tree to fall in the direction opposite to that at which it leans. Be sure to set the jack on a piece of wood so it will not sink into the ground.



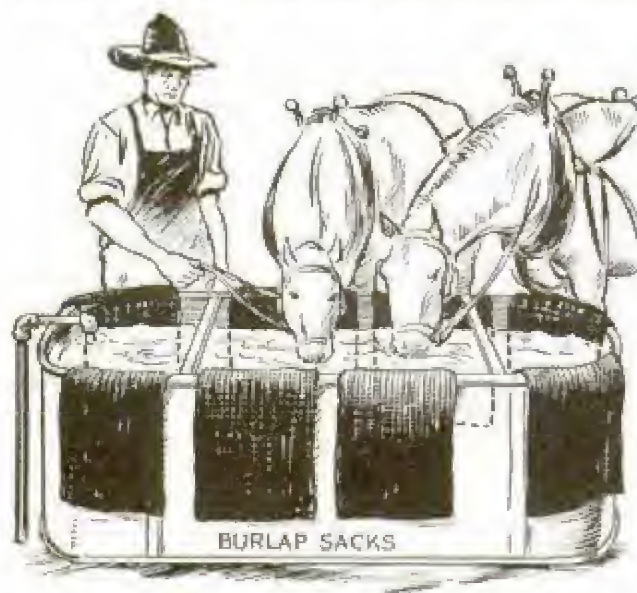
Wing Supports on Stepladder Prevent Tipping Sideways



While using a stepladder in picking fruit, one worker was annoyed by the tendency of the ladder to sink into the soft ground and tip sideways. To avoid this trouble, he hinged plywood flaps to the ladder near the lower end as indicated. These could be opened to provide a wide base for the ladder, or they could be folded over it for carrying.

Burlap Sacks Keep Water Cool in Stock Tank

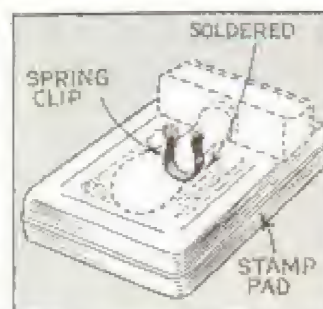
Several burlap sacks inserted in the water of a livestock tank so that they hang down over the outside will tend to cool



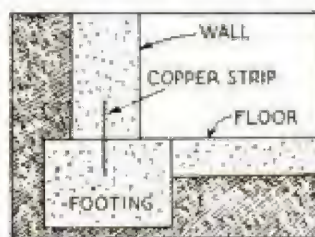
the water on hot, dry days. The sacks act as wicks, and as the water travels through the sacks it is evaporated, the action of which tends to cool the tank.

Rubber Stamp Held on Ink Pad by Spring Clip

To prevent his rubber stamp from being mislaid, one shipping clerk kept it in a spring clip soldered to the cover of the stamp pad. The clip not only keeps the stamp conveniently at hand, but also serves as a handle for opening the cover of the pad.



Waterproofing Concrete Walls



When a concrete footing is poured and later the wall poured upon it, the bond between them is not always watertight. To prevent seepage through such a joint, a contractor inserts a 4-in. strip of medium-gauge copper as shown. Half of the strip is imbedded in the footing, and the other half is buried in the wall when it is poured.

Applicator for Soldering Fluxes

Soldering fluxes soon destroy ordinary brushes used as applicators, but if you use pipe cleaners, they last longer, hold more fluid and can be replaced inexpensively. One end of the cleaner is made into a swab by wrapping it around a small nail or a match stick and the other end is used as a handle.—Kenneth Murray, Colon, Mich.

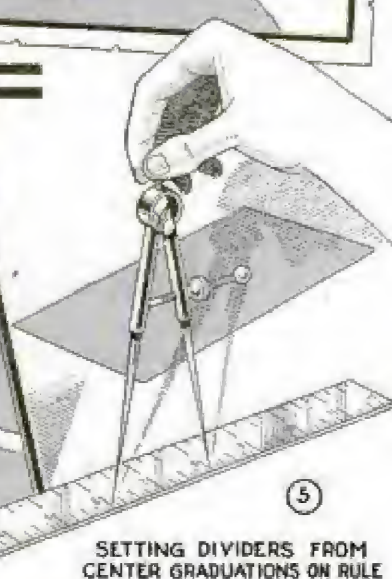
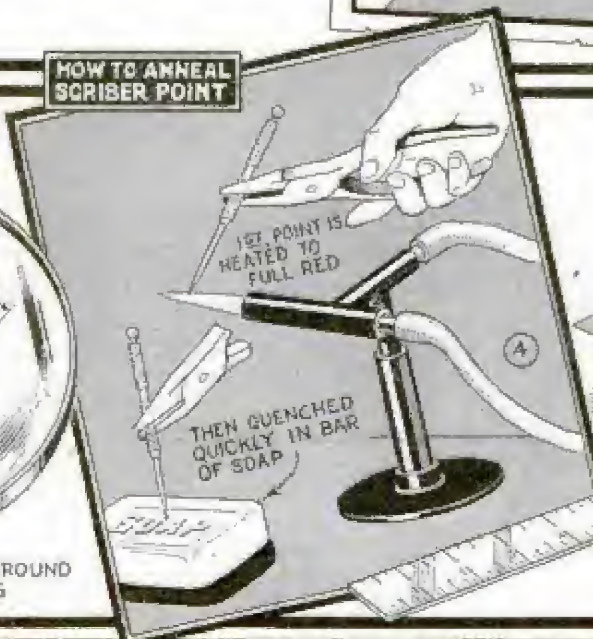
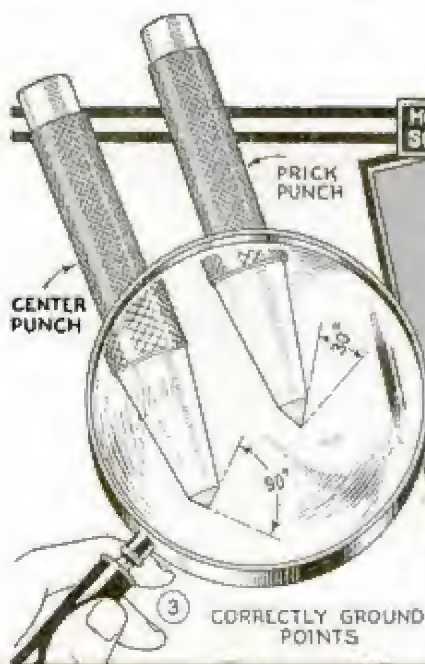
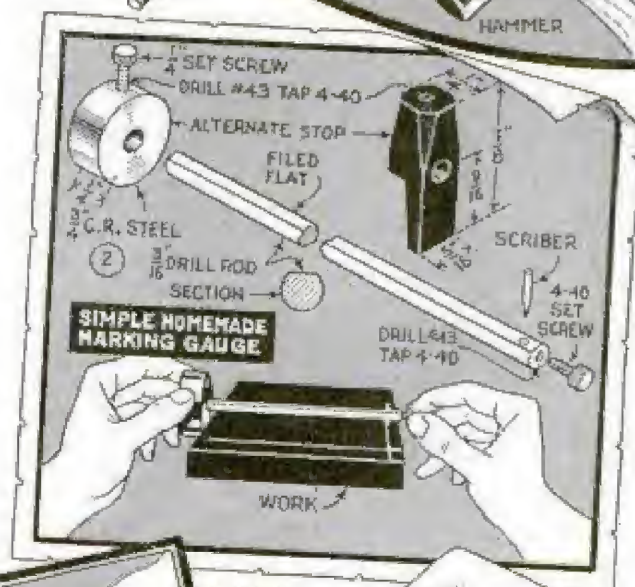
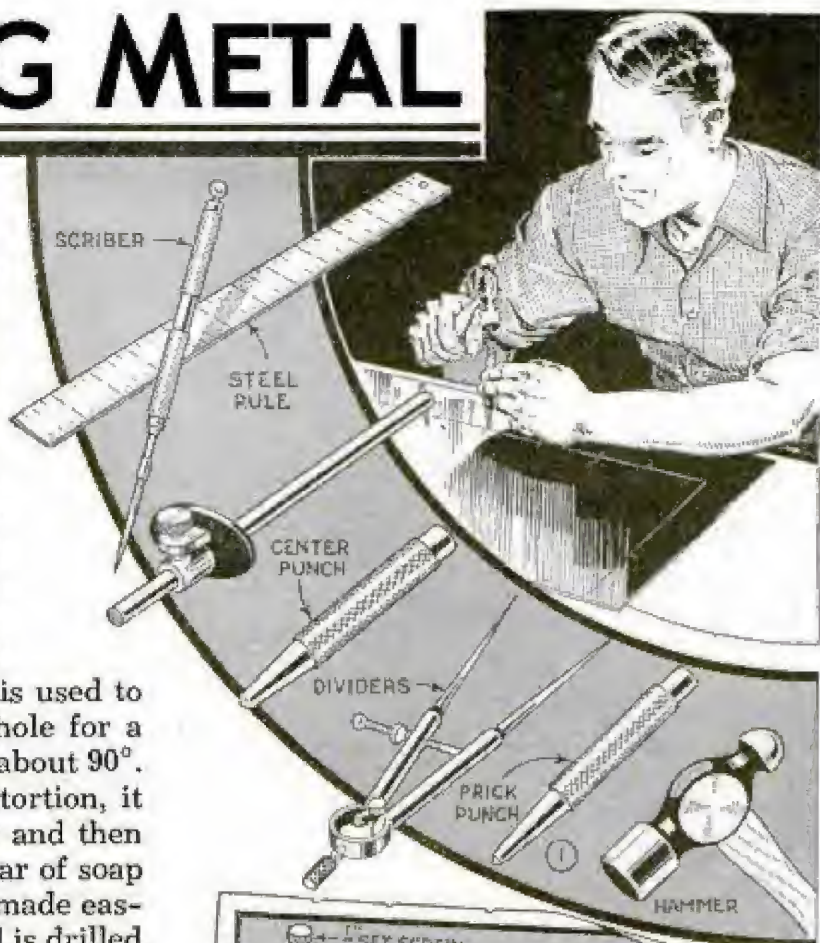


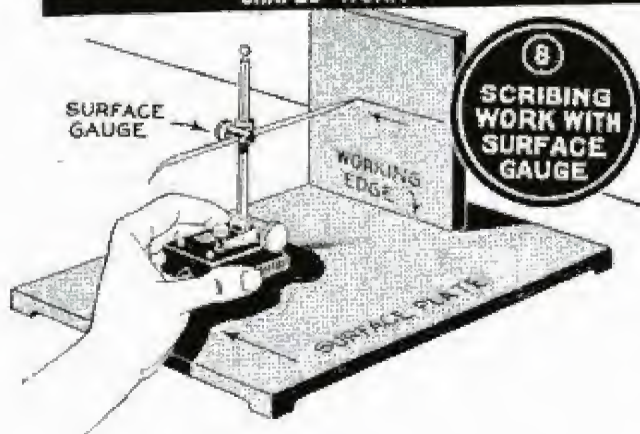
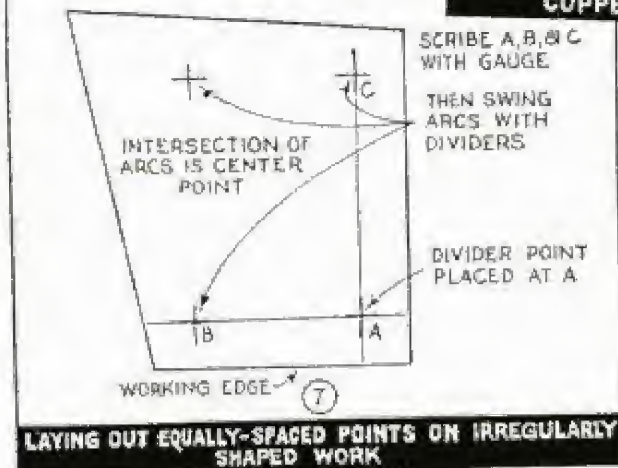
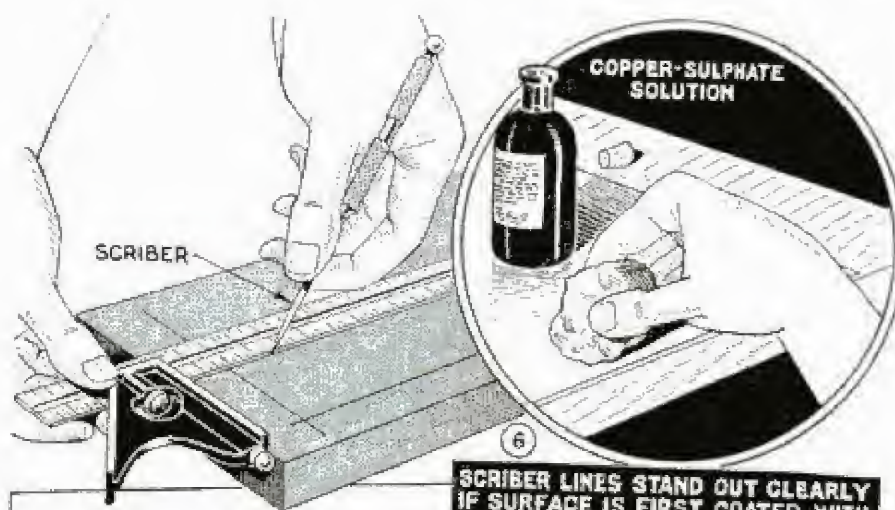
❑ Avoid rust on tools by keeping a bottle of oil and an old shaving brush handy to oil them after using.

MARKING METAL

LAYING out metal work requires that the surface be marked clearly at points where drilling, cutting or forming are required. Only a few simple tools are needed, Fig. 1, but they must be hard, to score or punch the work. If desired, you can make some of the tools, such as punches, scribes and marking gauges. A prick punch, Fig. 3, is used for marking a point, and has its end ground at an angle of about 30° , while a center punch is used to make an indentation to start a hole for a drill, and has its point ground at about 90° . To harden a scribe without distortion, it can be heated to a full red color and then quenched by plunging it into a bar of soap as in Fig. 4. Marking gauges are made easily from drill rod, Fig. 2. One end is drilled and tapped to take a set screw, which locks a scribe point in a hole about $\frac{1}{8}$ in. from the end. A piece of darning needle will do for the scribe.

To make scribed lines show better, many shopmen rub whiting, turpentine or chalk over the surfaces to be marked. Another method is to swab the clean metal surface with a solution made by dissolving a few crystals of copper sulphate in a cup of water and adding a few drops of nitric acid.





This solution is left on for a few minutes before wiping it off, Fig. 6, and covers the surface of iron or steel with a thin copper plate through which scribed lines will show clearly.

In setting dividers, it is generally easier to adjust them by feel rather than by sight. To do this, place one point in a convenient graduation of a steel scale and adjust it until the other point sets in the proper graduation, Fig. 5. The end of the scale should never be used as a starting point for measurement, as it may be inaccurate. In laying out work for drilling, a starting point from which to begin all measurements must be selected. Generally, a finished surface or edge of the piece is satis-

factory. To make clear the methods used in locating points for drilling, take as an example, the laying out of a metal block for four evenly spaced holes, as in Fig. 7. Knowing the dimensions of the block and the desired spacing of the holes, the marking gauge is set and a line AB is described with the gauge 1 in. from the side of the block. The gauge is then adjusted to $1\frac{1}{4}$

in. and a line AC is described. The intersection of these two lines marks the center of the first hole, and should be prick-punched carefully. The other holes can be located with dividers. Set them for a spacing of 2 in. and using A as a center, describe a short arc in the direction of C. The intersection of this arc with the scribed line locates hole C. Similarly, B is located, using A as a center. To locate the fourth hole, two arcs must be described, one at a distance of 2 in. from B and the other at a distance of $2\frac{1}{2}$ in. from C.

If a surface plate and surface gauge are available, the work can be rested on a suitable edge on the plate, and the lines scribed with the surface gauge, as in Fig. 8. In some cases, this is more convenient than using a marking gauge. If the surface gauge is not available, a machinist's square, or even a try square with a scriber clamped to it, provides a temporary substitute. After locating and marking the centers of the holes, the dividers should be set to a radius of the desired holes and circles drawn for each hole. Then before drilling, the center should be enlarged with a center punch to assure an easy start for the drill. Before the hole is enlarged to full size by the drill, the work should be examined to make sure that the drill is central. The line scribed about the circumference of the hole makes this easy.

Repairing Worn Crib Doors

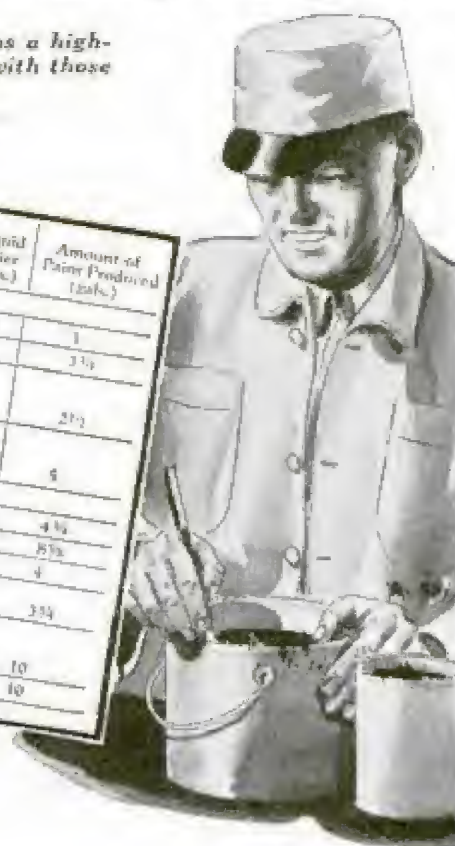
One farmer repaired sliding doors on his corner crib, that had worn and splintered at the lower edges, by facing the edges with angle iron. The wide side of the iron was screwed to the inside of the doors, thus avoiding any place for water to collect.

Chart Gives Paint Mixes for Many Purposes

Always use the best materials, as a high-grade paint cannot be obtained with those of an inferior quality



Surface	White Lead (lbs.)	Linseed Oil (gals.)	Lead Mixing or Reducing Oil (gals.)	Turpentine	Liquid Drier (pts.)	Amount of Paint Produced (gals.)
REPAINTING: Materials to cover 1,000 sq. ft. of surface (2 coats)						
Outside wood	45	1 1/4				
Wood shingles	55	1 1/4		1 pt.	1/4	1
Inside wood, plaster and wallboard	40		1 1/4	1/2 gal.	1	3 1/4
Outside stucco, concrete, stone and brick	70	4/4	2			2 1/2
NEW WORK: Materials to cover 1,000 sq. ft. of surface (3 coats)						
Outside wood	62	1 3/4				6
Wood shingles	103	3 3/4		1 qt.	1 1/4	4 1/4
Inside wood	96	1/2	1 1/4	1 1/2 gal.	2 1/4	8 1/4
Inside plaster and wallboard	57		2	3 pt.	1/4	4
Outside stucco, concrete, and stone	135	2 1/4	3 1/2			3 3/4
Outside brick	120	3 1/2	2	1/2 gal.	1 1/4	10
						10



By mixing your own white-lead paint, you not only save in cost, but you are assured of a high-grade paint, provided you use only the best materials obtainable. Also, remember that a careful, thorough mixing of the paint is just as important as good materials. The table above gives the recommended proportions of ingredients in mixing enough paint to cover 1,000 sq. ft. of surface two coats in refinishing old work, and for covering the same area three coats on new work. Do not guess at the

proportions. Always accurately measure or weigh the materials as stated in the table. And don't forget the surface to be painted. It is not only a waste of money to paint a surface that is not clean and dry, but it is discouraging to see the paint come off after a few months.

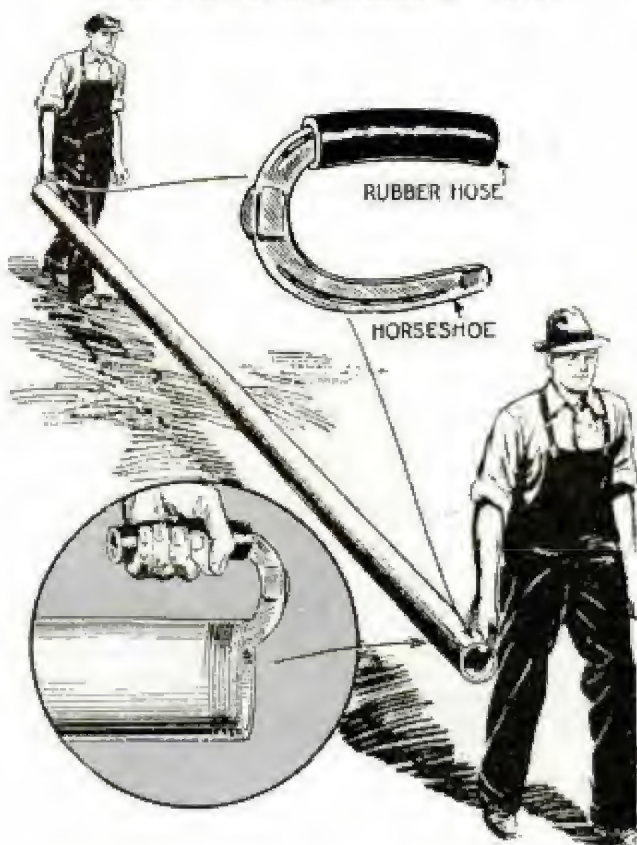
Drawers in Shipping Clerk's Bench Close Automatically

A shipping clerk who had to keep items that he needed frequently in the drawers of his bench, counterweighted the drawers so they would close automatically. This saved time and prevented the drawers from being left open where he would bump against them. Each drawer was counterweighted with a sash weight as shown. The weight should be just heavy enough to close the drawer, and the slides should be well lubricated for easy opening. The drawers, of course, cannot be overloaded if the weights are to close them.

❏ In making wood patterns for foundries, where wax is used for fillets in corners, filling holes, cracks, etc., it is difficult to make shellac or other coating stick to the wax parts of the pattern. If the wax is first covered with ordinary glue, and the glue allowed to dry, varnish will stick to it.



Horseshoes Provide Good Handles for Carrying Heavy Pipe



One contractor simplifies handling lengths of heavy pipe by inserting large horseshoes in the ends to serve as handles. The shoes are sheathed with rubber hose, and are especially useful when the pipe has been left outside in extremely hot or cold weather.

Pitchfork Serves as Holder for Binding Twine

To avoid losing a ball of binding twine when using it in the field, one farmer inserts a pitchfork handle through the ball

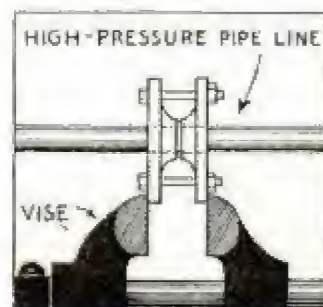


and forces the tines of the fork into the ground near his work. The fork also provides a good means of carrying the twine from place to place.

Joint in Pressure Line Repaired without Draining Pipe

Finding a leak at a joint in a high-pressure line that was caused by a damaged bolt used to tighten the flanges, a new one was installed without reducing the pressure, as shown. A small bench vise was propped under the joint so that both joint flanges could be gripped in the jaws, which were tightened to hold the flanges while putting in a new bolt.

—W. F. Schaphorst, Newark, N. J.



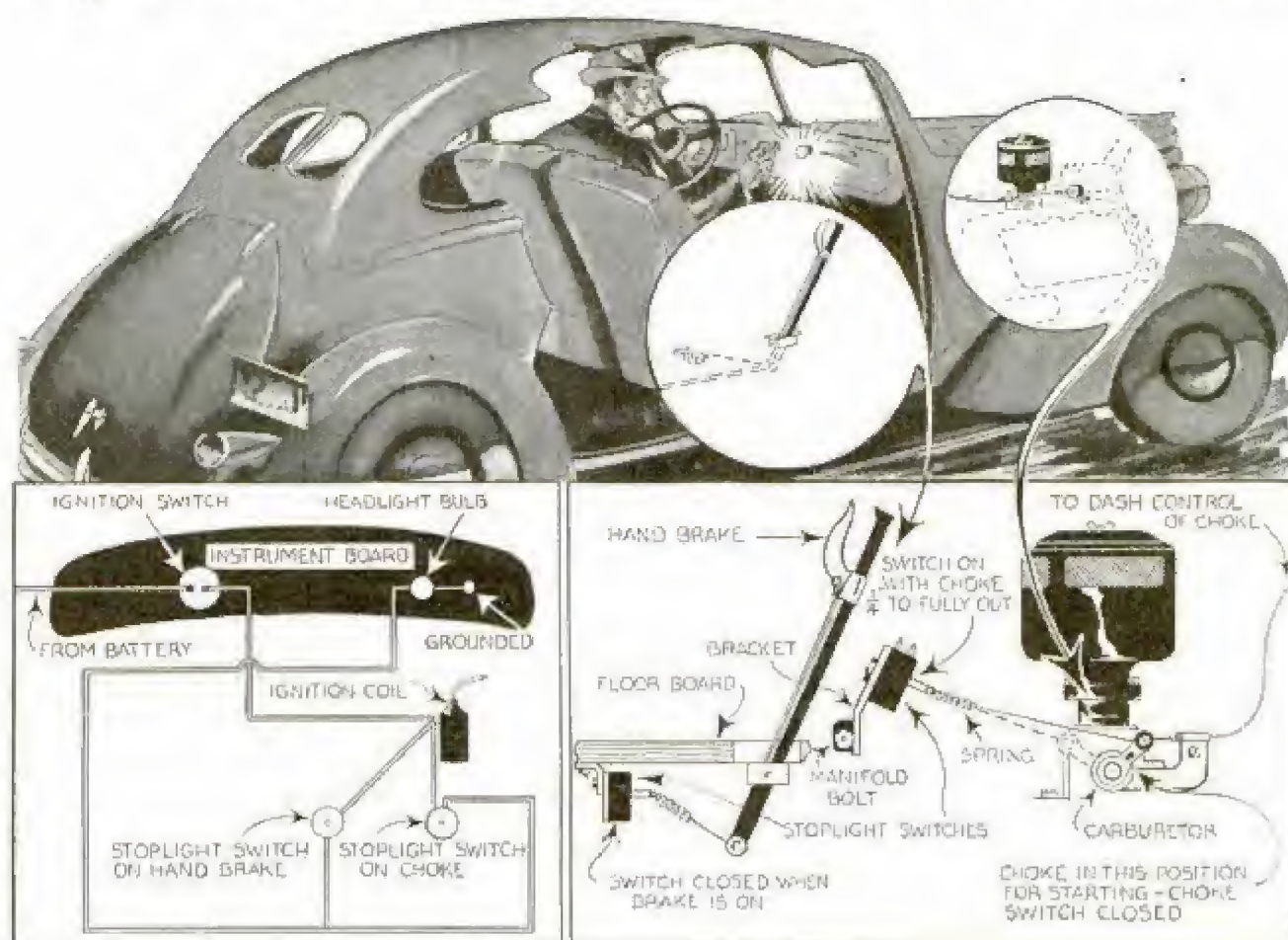
Librarian Keeps Magnifying Glass on Shelves to Read Titles



Noticing that some customers had difficulty in reading titles of books in the shelves, due to shadows and fine print, one librarian attached magnifying glasses to the shelves at convenient locations. Long cords were used in doing this to help assure that the glasses would not be carried away.—Opie Read, Jr., Chicago.

ⒼWhen the small springs that space the chuck jaws in a hand drill become damaged or lost, replacement can be made with the small springs used in an automobile tire valve.

Light Shows Choke Is Out or Brake Is Set



The owner of a car that was driven by various members of his family, mounted a lamp on the instrument panel and wired it so that it would burn if the emergency brake was on, or choke was pulled out. In this way, the driver was warned instantly if the brake was set. Also, the drivers that were too inexperienced to tell by the operation of the motor that the choke was pulled out, were constantly reminded that it must be pushed in as the motor warmed up. Two stoplight switches were used, one to be operated by the brake lever and the other by the choke rod. Notice

that a small coil spring is used in the linkage of each switch so that setting the brake tightly or pulling the choke rod all the way out will not break the linkages. As shown in the lower left-hand detail, one side of each switch was wired to the hot side of the ignition coil. If desired, they can be wired to the cold side of the ignition switch. Either method will cut off the current when the ignition switch is opened. This makes it possible to set the emergency brake when parking without turning on the warning lamp.

—John W. Schulz, Bay Shore, N. Y.

Easy Method of Synchronizing Dual Distributor Points

Distributors that use dual contact points and one or two coils, may be synchronized perfectly by the use of a lamp bulb placed in the circuit with the points. The distributor is first removed from the motor so that its shaft can be turned by hand. Then the points are wired into the circuit so that the lamp, which may be either 6 or 110 volts, will light when either point is in contact. If both points are open, the lamp

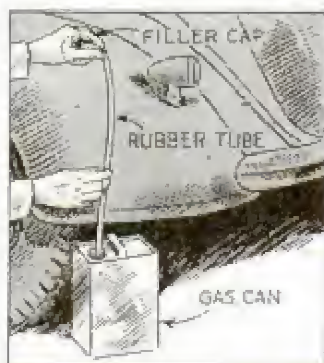
must be out. When the shaft is turned, the lamp will flash as either point makes contact. Due to the short interval between contacts, the light is out a very brief period of time. With a little practice, the flashes between contacts can be set to the same duration by shifting the movable synchronizing point. Setting the gap wider than needed and then resetting afterward will make the job easy.

Writing Materials Needed in Car Carried in Glove Compartment



Motorists who like to have pencils and paper handy in their cars, will find that the inside surface of the glove-compartment doors is a handy place to carry them. Sheet-metal clips soldered to the door can be bent over a strip of elastic to hold pencils, and a couple of rings, attached to the door by means of metal strips soldered in place, take a wide elastic to hold paper.

Sanitary Way to Syphon Gasoline from the Automobile Tank



The next time you syphon gas from your tank, start the syphon with your fingers instead of your mouth. To do this, insert the syphon hose into the tank, pinch it tightly at the filler hole with the fingers of the left hand. While holding the hose in this manner, squeeze it tightly at the same point with the thumb and index finger of the right hand and move the hand slowly toward the end of the hose. This operation removes the air from the

hose. Just before the right hand reaches the end of the hose, pause momentarily and release the fingers of the left hand. Wait a second and then release the fingers of the right hand. The partial vacuum created in the hose in this manner will start the gas to flowing.

—Ivan J. Stretten, Detroit, Mich.

Screwdriver on a Flexible Shaft Removes Hard-to-Reach Screws

Needing a screwdriver for access to screws that could not be reached conveniently with a regular driver, a motorist made a flexible one from a length of choke-wire cable. This was cut to the length desired, and a screwdriver blade was soldered to one end of the cable wire, and a handle for turning it was attached to the other end of the wire. Such a screwdriver is not suitable for heavy work, of course, but it will save time in removing small screws that are sometimes so difficult to reach.

—Ray Tetzlaff, Rhinelander, Wis.



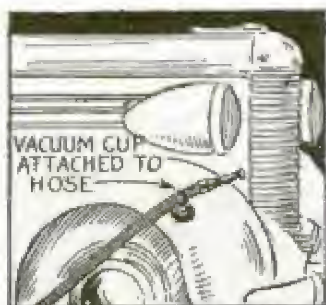
Spectacle Shields Prevent Glare



If you wear glasses, here is a simple method of reducing the glare of oncoming headlamps when driving at night. Cut two small, oblong pieces of green Cellophane and stick tiny pieces of cellulose tape to the ends of each. They can then be attached to cover the upper part of each spectacle lens, reducing glare but at the same time allowing a clear vision of the

road immediately ahead. Place the Cellophane pieces in a folder of wax paper when you are through with them each time, and they will last indefinitely.

Water Hose Kept Out of Mud by Vacuum Cup



When washing your car out of doors, the nozzle of the hose is apt to become soiled with mud when laid aside or dropped onto the ground. To avoid this, fasten a rubber vacuum cup to the hose, so that it may be attached to the body, or a fender, and held ready for use.

Weighted Standard Holds Door While Working Inside Car

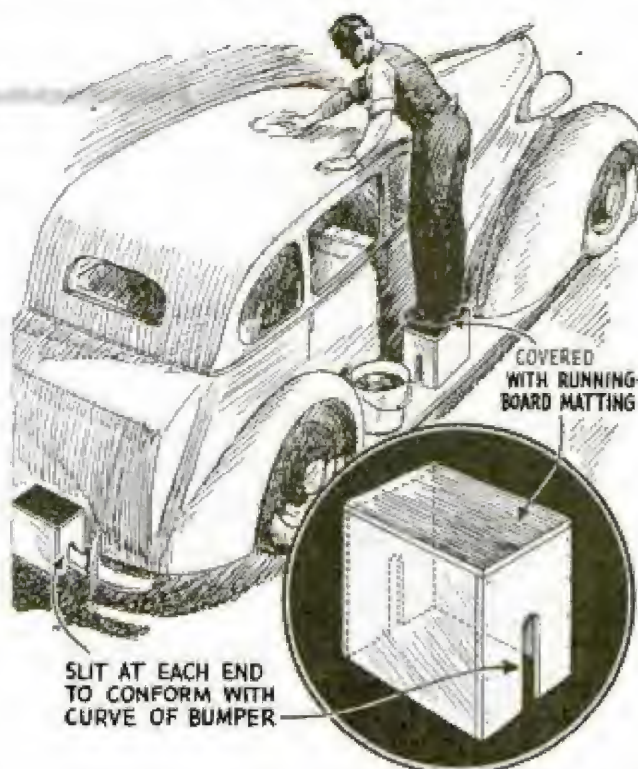
Finding that most car doors had a tendency to swing closed while he was working inside, one mechanic made a simple



weighted standard, which rested on the floor to keep the door open. The standard consisted of a heavy piece of metal with a rod or length of pipe projecting from it. The rod is covered with rubber hose to avoid marring the door.

☐ Covering grease-pit steps with felt cemented in place may save you a bad fall, as felt provides a safe footing even if greasy.

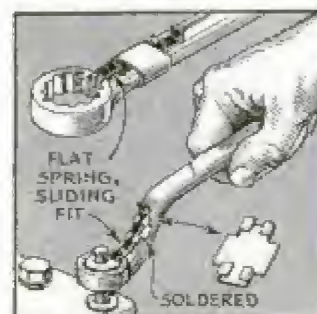
Stool to Stand on When Cleaning Your Car Top



A support that will sit on the running board or fit over a bumper to stand on while washing and polishing a car top, is made easily from a small wooden box. Be sure that it is strong, and renail it. Then slot each end so that it will slip over the top of a bumper as shown and cover the top with corrugated rubber.

Spring Slide on Box-End Wrench Prevents It Slipping Off Nut

In my work, I find box-end wrenches the handiest, but at times their use is rather annoying, because in turning a nut on or off a bolt, they have a tendency to slip off the nut when it is in the center of the bolt, as shown in the lower detail. To avoid this, I use a piece of flat spring to cover one end of the wrench.



The spring works in a slide made from thin metal and soldered to the wrench. The slide permits the spring to be moved to either allow the wrench to slip off the nut or to prevent it from doing it.

—R. Boettinger, Englewood, N. J.

Peepholes in Goggle Display Card Aid in Selling Them



Finding that his customers disliked to remove colored goggles from a display card to look through them, one service-station operator cut holes through the cardboard behind the lens of each pair. This enabled the customer to pick up the display card

and look through each pair of goggles without removing them and saved the dealer the trouble of replacing the goggles on the card each time a sale was made.

Preventing Theft of Ornament on Your Radiator

After having an expensive radiator cap and ornament stolen by a thief, who used a large screwdriver to remove the cap from the chain and crossbar that hung in the radiator filler hole, I altered the screw so that it could not be removed. To do this, a piece of fine wire was soldered in the screw slot so that a screwdriver could not be used. If it is necessary at some time to remove the screw, a hot iron will soften the solder.

—W. C. Wilhite, Carlinville, Ill.



Canadian-Type Canoe Is Easy to Paddle



16-Ft. Canoe—811 and 812

Used by the forestry service because of its steadiness on the water, this 16-ft. cedar-planked canoe which is covered with canvas is little affected by cross winds, because of its 33-in. beam. Finished canoe weighs about 70 to 80 lbs. Two plans (Nos. 811 and 812) contain all constructional details, material list and outline of procedure. Sent postpaid on receipt of 50c

More Plans on Boats You Can Build

"SKIPPER"—1018 to 1023: Low-cost outboard runabout for motors of 4 to 24 hp. Can be built for \$30 to \$40. 14 ft. long, 54-in. beam. Weight about 275 pounds. 6 prints \$1.00.

"HI-HO"—840 to 845: 14-ft. runabout powered by 11 to 22-hp. outboard or converted Ford motor. 58-in. beam. 6 prints \$1.00.

"ROAMER"—765 to 770: Outboard cabin cruiser. 16 ft. long, 66-in. beam. Requires outboard motor of 20 to 36 hp. 6 prints \$1.00.

"ARROWHEAD"—944 to 951: 21-ft. sailboat that can be built by average craftsman. Accommodates up to ten passengers, 6 prints \$1.00.

17-FT. KAYAK—928 and 929: Light framework covered with canvas. Single passenger. Weight about 40 lbs. 2 prints 50c.

12-FT. ROWBOAT—707: Flat bottom. Can be used with small outboard. Four seats. 25c.

"SEA SAUCER"—893: 9½-ft. lightweight sailboat. Planked with 3/16-in. plywood. 25c.

DUCK BOAT—703: One-man size. 10 ft. long, 34-in. beam. Can be carried on car. Sturdy wooden frame covered with canvas. 25c.

8-FT. DINGHY—995: Flat bottom, length 8 ft., beam 40½ in. Can be used as tender for large boats or for rowing and fishing. 25c.

Any six of these plans (not sets of plans) will be sent upon receipt of \$1.00

Catalog listing 400 plans included free with your order if specified, or sent separately for 3 cents to cover mailing

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Used in Industry
Throughout the World



10" swing x 3 1/2' bed 1" Collet Underneath Belt Motor Driven Bench Lathe, with All Steel Bench. Shipping weight 890 lbs. \$700.00

South Bend Precision Lathes are built in six sizes, 9" to 16" swing inclusive. Each size is made in Tool Room Type, Quick Change Gear Type and Standard Change Gear Type with individual motor drive or countershaft drive. Throughout the world South Bend Lathes are giving dependable service to industry.

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9" x 3' Workshop Model C Bench Lathe with Horizontal Motor Drive and reversing motor, complete as shown. Shipping weight 320 lbs. \$109.50



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For 9" x 3' Workshop Model C Lathe Less Drive

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11"—Lathes	3½' to 5½'	388.00 to 941.00
13"—Lathes	4' to 7'	478.00 to 1144.00
14½"—Lathes	5' to 10'	609.00 to 1431.00
16"—Lathes	6' to 12'	723.00 to 1578.00

Below—11" x 4' Quick Change Gear Underneath Belt Motor Driven Lathe. Shipping weight 965 lbs. \$625.00



Above—16" x 6' Quick Change Gear Pedestal Motor Driven Lathe. Shipping weight 2165 lbs. \$938.00

Left—9" x 3' Workshop Model A Quick Change Gear Bench Lathe with Motor Drive and motor as shown. Has power carriage feeds. Shipping weight 340 lbs. \$199.50

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HULL MFG. CO., P. O. Box 246-D7, WARREN, OHIO



They Move Anything

(Continued from page 63)

ing apparatus set consumed seventy-seven days, but the actual joining of the two halves of the building was effected in a single night and persons inside couldn't feel it move.

"Business as usual" went on during the moving of a telephone exchange in Indianapolis. Six hundred employees went about their duties, elevators were running, drinking fountains working, calls came in over 542 long-distance circuits. But all the while, engineers were placing the 11,000-



Placing jacks under 2,200-ton observatory, which was moved without disturbing delicate instruments

ton building on rollers, shoving it to the rear of the site and turning it to front on a different street. Utilities, heating, and sewerage facilities were maintained during the move by flexible connections, and the maze of telephone wires entering the building was handled in much the same fashion, by splicing 200 feet of slack into each circuit.

To every big mover comes at least one unusual job that he never forgets. In fifty years Grant Renne has moved everything from mausoleums to grandstands, but his outstanding assignment came several years ago in Kansas City. The city health director called him to move a hospital back from the river bank before rising waters

toppled it. Inside this building were sixty-five smallpox patients who could not be removed. Renne put it up to his men; all but one volunteered for the dangerous project, and the isolation unit was moved in safety to patients and workmen.

Not long ago, a Texas oil company was offered a bargain in two 35,000-gallon steel gasoline tanks. The only trouble was that they were a mile and a quarter from the refinery where they were needed. The company purchased them with the idea of dismantling them, trucking the metal sheets to the refinery and reassembling them.

A mover, Verne Watson, offered to save the oil company money by moving the tanks as they were. His proposition was accepted. Over short distances, oil storage tanks are no trick to move. All you have to do is dig a ditch and float 'em to the new site. But here the digging of a mile and a quarter dyke and filling it with sufficient water to float a tank seventy feet in diameter would be more like a government project. A more practical method of transporting the 220,000-pound tanks was sought. Tests were made, and eight steel dollies were found to be most satisfactory and the tanks negotiated the trip intact.

For fear gas chambers might form underneath the tanks, officials would not permit digging holes in the sand foundations on which the tanks were to rest. Watson had figured on digging trenches under the tanks at the refinery to allow the workmen to crawl out with their jacks as soon as they had the tanks spotted. That method barred, he solved the problem with ice. Eighteen 300-pound ice cakes were cut in half and the blocks placed on top of one another under all supporting columns. The jacks were then removed and as the ice melted the tanks were brought slowly down to earth.

A few of the cakes did not melt as fast as the rest so Watson took a .22 rifle and shot a few times into the slower melting blocks—and the job was done, the oil company saved \$6,000.

¶ Nearly half the world's 41,090,347 telephones are in the United States, where there are 91,000,000 calls a day; New York City alone has 1,632,348 telephones, more than France and three times as many as all Asia.

New York Telephone Co.
JULY, 1940



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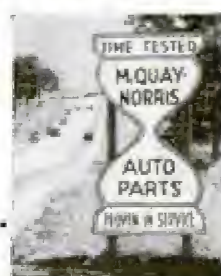
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McQUAY-NORRIS MFG. CO.

St. Louis, Mo.



X52

Masters of Destruction

(Continued from page 43)

At each building on the set a solenoid valve controlled the flow to that particular place. By opening the oil valve at the pump, Zavitz pumped a combination of eighty-per-cent distillate and twenty-per-cent gasoline to the set. The other valve poured plain water into the lines. Firemen declared Zavitz daffy.

"You can't pump gasoline that way even if everything else works," they contended. But it did work and the powder man pumped 1,000 gallons of oil a minute into the buildings when the director wanted fire, then put it out by opening the water valve if he wanted to move the cameras for a different angle.

Each powder man has his own ideas of powder, materials and safety devices. There is no standardization, though a studio often standardizes material and explosives for one picture. Warners did this when Ralph Webb, Earl Ball and Fred Ponedel handled battle scenes for "The Fighting 69th." The men used 1,750 pounds of black sporting powder, 450 pounds of dynamite and ninety pounds of flash powder. Land mines were six and twelve ounce medical cartons filled with black powder with a squib as a fuse.

They were buried eighteen inches to two feet in specially prepared holes lined with screened earth, covered with sawdust and broken cork. In a half-square-mile area of battlefield, 208 of these were placed. Augmenting them were torches, flares on parachutes and scores of nine-inch star shells designed to travel 500 feet and burst. The shells were shot from a heavy paper mortar by an electrically fired squib.

Everything was fired by powder men from six control boards. Webb used a six-wire cable running from the firing boards to a clip or spider board in the field. From the spider board to the bombs was but a short distance and four-ohm resistance wires were used as connections. Such a wire cable connects five bombs with the sixth wire used for a ground. Some powder men insist on a ground for each bomb. A forty-five-volt battery furnished electricity for firing.

The firing boards of all the powder men are so rough that engineers express amazement at their effectiveness. In most cases

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K 52

an ordinary sawhorse is used with a row of spikes driven in it. Wires connect each of these nails to a bomb and the batteries, while the powder man carries the striker and connecting wire to complete the circuit in his pocket when he is not firing. When he is ready to shoot, he hooks the short piece of wire he carries to the positive pole of the battery and fires every time he touches the striker to a nail on the sawhorse.

Timing must be perfect, otherwise a man or horse running beside a mine will be injured. By slanting the walls where the shot is buried, the powder man can turn the force of the blast in the direction desired. Webb fires twelve ounces of black powder within five feet of players. Zavitz fired five-per-cent, six-inch dynamite bombs set in three-eighth inch steel drums eighteen inches deep, within two feet of three horses running in a triangle.

In the picture "Army Girl," eighteen five-per-cent dynamite bombs were fired around and under an army whippet tank so cleverly the crew was not conscious of a jar, despite the fact it looked as though the machine would be destroyed.

Walter Hoffman, dean of the powder men, claims water shots are hardest to make because of the resistance, and a grounded airplane one of the easiest things to destroy. His hardest land shot was to blow up a big truck with three autos filled with players, twenty-five feet away. He did it safely by placing dynamite on the rear axle and dropping an extra tailgate behind to confine low-flying parts.

Technicolor has brought new worries to powder men. Growing use of color has made it necessary to restudy powder to meet requirements for the spectacular. Increasing use of lycopodium has been one result. This expensive powder gives the effect of rolling flame. Hoffman uses fuller's earth for white effects. Charcoal and ground cork have long been used for black. Needed most now are cheap powders that will make colored smoke, and powders to make colored flames of blue, green or pure white.

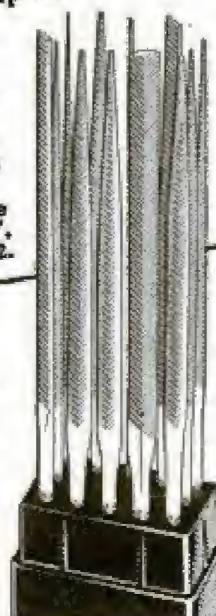
Greatest of all needs, the experts agree, is strict state licensing of people handling explosives. California has no license examination and that of Los Angeles is cursory; but a license is not even required in the studios!



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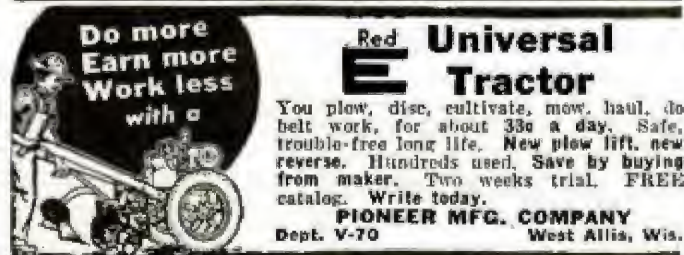
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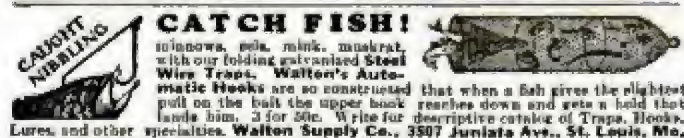


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K106 The Battle of Dazzle

(Continued from page 59)

in splotches of many colors, carefully selected, the colors mingle at a distance in an indistinct gray that has lower visibility than a ship completely gray.

Airplanes are painted, like birds, with dark upper surfaces and light under surfaces. When viewed from the earth, planes are seen against a blue background, and for that reason lighter colors lower their visibility. By the clever use of colors an airplane can be made virtually invisible at high altitudes. When viewed from overhead by pursuit planes, aircraft are against a brown and dark-green background. Their visibility is lessened when the upper surfaces are painted with colors that blend with the surface of the earth. Bomber planes, which usually operate at night, are painted a dull black to deaden the reflection of searchlights.

Release by the German government recently of aerial photographs of London indicates how extensively aerial photography has been developed by the European powers. One of these photographs shows in great detail the storage tanks holding petroleum so vital to England in carrying on the war. Camouflage now would be of little value in respect to those oil storage tanks, for the enemy already has detailed photographs of their position. This situation illustrates that camouflage for fixed objects in the future must be planned long in advance of when it may be needed. Power plants, oil storage tanks and other vulnerable works may disappear from European landscapes in the future if the martial spirit continues unabated.

Camouflage as now practiced attempts to deceive both the eye and the camera of the enemy in respect to (1) color, (2) light and shadow, (3) shape, (4) movement, and (5) visibility.

Probably the earliest effort was the simple expedient of hiding behind a tree. A variation of this was to hide in the branches of a tree and, wholly concealed, jump down upon an unsuspecting adversary.

In comparatively early times attention was paid to color of clothes as an aid to concealment. Some of Robin Hood's men are said to have worn green costumes in summer when the land was verdant, and brown clothes when autumn had trans-

K 10 G

formed the foliage into shades of brown. But camouflage apparently was a neglected or unknown art during the eighteenth century when the British soldiers wore bright red uniforms and marched in solid formation.

Not until the Boer war did British uniforms get down to a practical and utilitarian basis. Following its experience in that war Britain in 1903 adopted khaki serge for her troops. "Khaki" is an oriental word meaning dusty. The color was adopted both because it does not soil easily as do brighter colors and also because it affords a measure of concealment. The United States has standardized on uniforms of olive drab color, it being felt that this particular shade has greater camouflage value in military operations. The German army wear uniforms of a peculiar gray shade, it being claimed that this shade has high camouflage protective value in northern climes (Germany is in the same latitude as Labrador). The French main army have uniforms of "horizon blue," but the French colonial armies wear khaki. Finnish troops wore white garments on the snow fields during their struggle against the Russians, with satisfactory results.

The outstanding classic example of camouflage is related by Homer in the Iliad. He tells how the ancient city of Troy, besieged for nearly a decade, was finally captured through the stratagem of erecting outside the walls an immense wooden horse. The besieging Greeks let it be known that the immense horse was constructed as an offering to Minerva, a goddess who was angry with the Greeks and was aiding the beleaguered Trojans. The inside of the wooden horse was filled with armed men and the other Greeks repaired to their ships as though to depart. The Trojans thought the enemy had abandoned the siege, so they dragged the horse inside the walls. That night the men in the wooden horse emerged and opened the gates of the city to their comrades who had returned. The city was set on fire and Troy was subdued.

☞ A few years ago passengers on air liners were given cotton to stop their ears against the roar of the plane; today the noise level in the cabin of a sleeper plane is so low passengers are asked to talk quietly so as not to disturb those asleep.

Science Service.
2/12/40

JULY, 1940

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Makers of TOMCAT Court-Tested Tennis Strings

Radio to the Rescue

(Continued from page 53)

emergency telephone service to isolated communities that portable transmitters and receivers have been adopted widely throughout the Bell system.

By rigging ambulances with two-way radio, hospitals have expedited the handling of rush cases where every second counts. While a patient is being hurried to the hospital, the attending interne or physician can advise the hospital staff whether an operating room, oxygen tent, or some other service should be held in readiness.

Although government forestry agencies have been using radio in their work for years, non-government forces have just

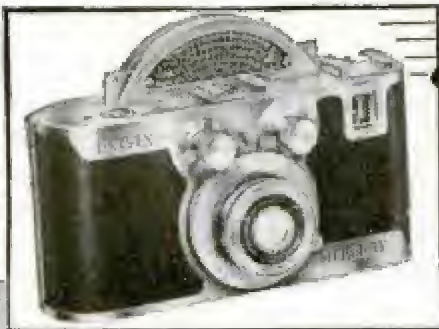


Fire departments find the two-way radio useful in various kinds of emergency service

taken it up since frequencies were made available to them a little over a year ago. Closer cooperation between airplanes and mobile units now is possible in the New York Conservation Department, as messages from plane to fire observation towers or from plane to truck have been found practical up to eighty and ninety miles.

Periodically between 1913 and 1917 efforts were made to fit wireless telegraph and radio telephone to the water forces of the New York fire department that cover the 651 miles of Manhattan waterfront, but the concentration of skyscrapers, steel bridges, and topography of the land militated against adequate coverage until General Electric designed the present system.

(Continued to page 124A)



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(Continued from page 122A)

The system consists of a medium high-frequency headquarters station of 500 watts in the Borough of Queens, seven ultra-high pick-up receivers located at strategic points, a control unit at Manhattan fire-alarm central office and two-way units on fireboats and official cars.

If a signal from any of the boats goes out on the air it is picked up by some or all remote receivers, and is then conveyed automatically over the connecting land lines to the control room in Manhattan. Any reports or instructions emanating from the control room go by wire to the transmitter and from there to the boats via radio. Boat-to-boat communication also is possible.

Many municipal fire departments now regard two-way radio as important as booster pumps and ladders. Snow fighters, whose job it is to keep roadways open in the high Sierras and the Rockies, are beginning to wonder how they ever got along without it. New York tugboats are seeking to use short wave in berthing liners and other towing operations. The railroads, too, are expected to become short wavers. Not long ago, on a Lehigh Valley freight train running between Buffalo and New York, sending and receiving sets were placed in both the engine cab and caboose so the engineer and train crew could keep in close touch with one another. Trials have been made to good result with controlling and dispatching trains.

Backbone of the emergency service is still police radio. Approximately 800 stations are now on the air but in the opinion of Fred M. Link, consulting engineer, who has been connected closely with this field since the beginning, that is only a fraction of the number that will take to the air lanes within the next few years. One of the most comprehensive uses of radio in police work is found in Cleveland, first of the major cities to reconstruct its police department around radio. It is making possible greater police protection than ever at less expense.

Directed by Lloyd N. Chatterton, the system has three transmitting stations spotted so as to assure complete coverage of the city; two-way equipment for radio patrol cars, and receiving equipment for motorcycle details and ambulances. Police organizations of fifty-six suburbs covering an area of 600 square miles are in the process of installing equipment so they can be-

K96
come integral parts of the system. The seventy-three square miles of Cleveland proper have been divided into thirty-two patrol districts with a prowler car policing every corner in a district hourly. As a back-up for the patrol cars there are seven roving detective cruisers which assist on emergency cases and carry out the major portion of the investigation on calls, so the regular cars won't be out of service too long. A patrol car is within three-eighths of a mile of any point in the city, Chatterton explains, and in a matter of seconds one can be summoned to duty. Emergency telephone calls and complaints are routed directly to the radio dispatcher's office and many are on the air before the caller hangs up the receiver.

Friction Fighters

(Continued from page 93)

Pole on his latest expedition is fitted with the largest set of roller bearings ever made for installation in wheels. Thirty-two inches in diameter they are equipped with rollers especially manufactured for very heavy duty. The result is a bearing that will take 625 per cent more load than it will ever be called upon to take.

People who remember the early "ball-bearing" roller skates, which consisted chiefly of cast-iron wheels, grooved to hold a number of more or less round balls, would stand amazed before the refinements which have been made on all types of bearings. Precision has come into the picture for all—roller, ball and thrust bearings. Accuracy to one-millionth of an inch is achieved. One concern, Timken Roller Bearing company, does it with mirrors. A machine so delicate that it must be kept in an air-conditioned room has aided in development of a super-finishing process on the metal raceways in which rollers revolve that eliminate irregularities not even visible with a microscope. Reduced to its fundamentals this instrument consists of a light beam reflected between a series of mirrors, the first of which is hinged and changes its vertical angle as the specimen is drawn along under it. This is accomplished by mounting the mirror on a lever pivoted in the center, with a diamond point on one arm and the mirror on the other. As this diamond point contacts the speci-

(Continued to page 126A)



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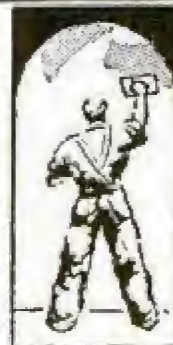
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men surface it moves the mirror system by any tiny irregularity. This movement is transferred by the mirror, tilting it and deflecting the beam of light. This deflection is accentuated in reflecting off each mirror. Finally the beam runs through a condenser which reduces it to a pin-point size and focuses it on a revolving cylinder of sensitized paper. When the paper is developed, irregularities of a millionth of an inch show up like saw teeth.

Also, in the Timken laboratory are eight machines designed to test the life of bearings by running them to destruction under radial and thrust loads. Automobile rear axles and transmissions, and the bearings used in them, are tested in an electric dynamometer and two hydraulic dynamometers. These units allow speed ranges of 200-400 revolutions per minute on the propeller shafts, which makes the equipment useful not only for testing the bearings, but also for checking the oil-flow characteristics of axles.

In the same laboratory is a machine, one of the largest in the world, which can test both single and double row bearings up to twenty-four inch, outside diameter, for fatigue under both radial and thrust loads. Radial loads up to 500,000 pounds and thrust loads up to 200,000 may be applied to the bearings under test by means of hydraulic rams.

Every heat of steel used in bearings is tested several times during the manufacture on interesting research machines. For example, there is a gas extracting device consisting of glass tubes, pumps, etc., built with such precision and accuracy that it can extract, quantitatively measure, and qualitatively analyze the gas content of a given piece of steel. Another machine stretches small bars of steel until they break. Important in the structure of the steel is the placement and arrangement of microscopic magnesium crystals scattered throughout the steel. The laboratory has a machine which not only reveals the magnesium pattern, but photographs it.

No matter what the strain—a five-minute job with your vacuum sweeper or a 200-mile run by a mile-a-minute train—science is busily engaged in reducing it by developing its friction-reducing "beast of burden"—the bearing—to new high levels of efficiency.

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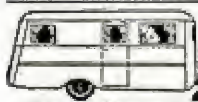
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X96

Our Flying Navy

(Continued from Colorado Section)

from the cruisers," Dick tells you, "until you've done it. You carrier birds make a lot of noise and blow big holes, but it was my gang that told you where not to waste time looking for the enemy. It starts with the kick of the catapult, and from there on you're a pair of flying eyes; and when those eyes find the enemy you're set for a busy time. You're dodging enemy planes, radioing details of numbers, types, speeds, directions, probable intention, and at the same time you're trying to keep out of range of anti-aircraft guns. You fly as long as your gas gauge shows enough to get back to your ship, and how those cruisers move around in your absence!"

The battleship planes have their own big problem, too. While the dreadnaughts are blasting away, the planes sit up near the clouds radioing instructions for the gunners; and when the ships are not even in sight it's no easy task to determine which ship is firing short or over the target, and to coach that ship on to the mark.

Harry, who was graduated from Pensacola to a flying bomber on Hawaiian patrol duty, has another story to tell.

"We scout for thousands, not hundreds of miles," Harry relates. "And what's more, when we find what we're looking for we go right in and do an attack job. The big boats are ready to fight far ahead of the fleet and its flock of 'homing pigeons'."

Your patrol squadrons, he says, are operated as tactical units, and on a scouting job during fleet exercises you're one of a group of twelve planes fanned out to cover a line several hundred miles long. You must keep that line precise and exactly abreast, even though you can't see one another and radio silence prevails. That means the most exact brand of navigation. The first to sight the objective breaks radio silence and calls a rendezvous. If you've measured your drift exactly, kept your bubble octant working well enough to give confirming lines of position, or gotten radio bearing, you're set. But it's never that easy. Fog, overcast, atmospheric conditions always complicate things. You check on the dead reckoning at every opportunity. When off duty as pilot you do the navigating, while your relief watches the instruments and the automatic pilot. One

1296
man is always on duty as radio operator, a mechanic constantly watches engine indicators. There's no relaxing.

Flying is the easiest part of the show. It's the landings that generally beat you down. The squadron returns from a twenty-four hour jaunt to find a sudden fog over the harbor. There you are, blind as a bat, above a fifty-foot ceiling. On your inter-plane phone you hear your skipper call the ground. The reply snaps back: "Circle until further communication." For twenty minutes you carry on, straining eye muscles to keep a safe distance from the plane in front. Phantom planes steal up to your wing tips. You wipe imaginary fog from inside your windshield. Then comes the voice from below through the head phones: "Radio-equipped boat is stationed in harbor. We will coach you to landings. Come through the ceiling one at a time."

You get set.

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The first section slants down out of sight. Your section leader starts. Now it's your turn. Every man is quiet and busy at his station. Outside, a solid wall of cloud presses against the windows.

You follow the instruments with infinite care. Three sides of the square, another right turn. Start your glide. Down, down you go. "You're OK, come on in," sounds the reassuring voice. You hold your breath as the altimeter reads 100 feet, seventy-five feet, fifty feet, then you break into the clear! In a few seconds you're down, taxiing over the bay, still faintly streaked with the white wakes of preceding planes. You pull out of the landing area quickly.

One of your crew is hanging over the nose in a safety belt, boat hook in hand, ready to snag the buoy. Everyone at his routine job. You wonder what they were thinking back there in the ceiling.

"The Officer of the Day greets you on the dock with 'Pretty thick up there, I hear,'" Harry finishes. "You grin back. The OD is an old hand. He's been up in all types, and he's always told you all planes handle the same in fog, and they all get their share of the breaks, good and bad. Air philosophy, he calls it—the kind that comes with Navy Wings."

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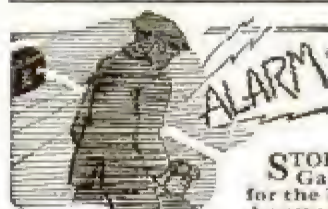
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WARNER ELECTRIC COMPANY
360 N. Michigan Ave., Chicago, Ill., Dept. 5-C

Secrets of Big League Batting

(Continued from page 69)

self and even if you hit a little below or above the center you should get a good drive. Most good hitters squint at the ball as if aiming a rifle. Both eyes are in use but the one nearest the bat does most of the work.

Sometimes you can tell, the instant the ball leaves the pitcher's hand, whether it will be a fast one. You won't get very far if you try to guess ahead of time what the pitcher will throw and where he is going



Danning has pulled his body around in an attempt to hit to left field, has just finished wrist snap

to throw it. The only safe rule is to follow the ball with your eyes and try to meet it.

As a catcher, I have to remember the hitting stances of many players. If the batter is planning to hit in a certain direction he may modify his natural stance to get set for the hit, and if this happens I can signal the pitcher, bringing a pitch that upsets the batter's plans.

At the same time, a batter may use a change of position like that to try to decoy us into sending him a ball that he wants. Another trick the batter may use is to glance several times toward one part of the field as if he were preparing to hit toward it. Naturally, the pitcher will feed him

2 1468
something that he won't be able to hit in that direction, and by elimination the batter may be able to judge quite closely what kind of a pitch he is going to get. But he still should follow the ball with his eyes instead of getting set for it ahead of time.

Another good trick is to fake a bunt and then draw back at the last moment and let the ball go by. The basemen may decide that you probably will bunt the next pitch and start to draw in toward you. Having gotten them out of position, swing at the ball and hit it instead. Another bunt trick, so hard that it is rarely tried, is to start a bunt as the pitch is made, to draw the basemen in, and then at the last moment shift to the regular position in the hope of hitting into the unguarded territory. That requires split-second action.

The bunt is a specialized type of hitting. Right-handers push at the ball and left-handers drag the bat around to hit it just as they are getting into motion on their way to first base. For a sacrifice bunt you face the pitcher and hold up the bat with hands apart in front of the ball. The extended hand should hold the bat so loosely that the bat is knocked slightly backward by the impact. The ball just dribbles away instead of rebounding. Keep the thumb of your extended hand behind the bat. Otherwise it may be hit by the ball.

The best hitters seem to have a natural knack for hitting just as the best pitchers have natural control. Anyone's ability to hit can be improved by good coaching and practice.

One thing you shouldn't do is to try always to knock out home runs. You'll be a better hitter if you don't try to slug. Likewise, don't change from the style that seems comfortable to you just because some other hitter's style is different. There are a lot of different hitting styles in baseball and some of them look strange, but they work and that's what counts. Don't stride too far before starting your swing and don't develop any fancy little "hitches" that interfere with a normal, full, and easy swing. Finally, keep in mind that you can hit. Confidence counts a lot.

❑ If you will send stamped, self-addressed envelope to our Bureau of Information, you will be given the name and address of the manufacturer of or dealer in any article described in this magazine.

JULY, 1940



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Why volcanoes vary in size and behavior and the competition that "medicine" men give physicians in the Congo are but two more of over a score of scientific digests that you'll find make interesting summer reading. A million words were read to give you these ninety-six pages—an amazing value for just a quarter.

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X 78

The Good Earth Goes to Sea

(Continued from page 85)

ed with Kuzdu—an oriental vine, which nets down and stabilizes the biggest wash in a year or two. Smaller gullies have their heads and sides graded, after which they are sodded, the sod being staked and wired down until the grass roots catch.

Temporary check dams are frequently used to hold soil and moisture on the bottom of sterile gullies so that vegetation can be established. Where the run-off is small, a closely compacted pile of rock and brush across the bottom of the gully is sufficient.



Section of field showing how basin listing makes small reservoirs to hold rain water

To check violent run-off, dams are made of woven wire, brush woven to anchored stakes, or loosely fitted rock. Where the cost is justified, permanent earth and masonry dams have been built.

In the dust bowl on a few fairly large tracts, experts have already demonstrated that they can stop the movement of earth. The dunes were first leveled with scoops and scrapers, then the fields were basin listed, making reservoirs to hold the meager rain. Field crops were then planted in alternate bands with such shelter crops as sorgo. Then shelter belts of fast-growing trees were planted to break the wind.

Still another strategy has been to lay out fields in S-like furrows and strips, so that no matter where the wind blows from, it cannot sweep across any treated field without being opposed by a strip or earthwork at least every 500 feet.

Tied down like this, the good earth is gradually losing its hankering to go to sea.

Send stamped, addressed envelope to our Bureau of Information for name of maker of any device described in this magazine.

JULY, 1940

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Chicago, Ill.
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Same as above but with Prontor II shutter; speeds T & B, 1 to 1/175 sec. and delayed action \$15.95

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Lens Diam.	Sunshade Plain	Type	Lens Diam.	Sunshade Plain	Type
21 mm.	75c	A	30 mm.	1.98	95c B
23 mm.	\$1.69	75c A	32 mm.	1.98	95c B
24 mm.	1.69	75c A	33 mm.	1.98	95c B
25.5 mm.	1.69	75c A	36 mm.	2.49	95c C
27 mm.	1.98	95c B	37 mm.	2.49	95c C
28.5 mm.	1.98	95c B	39 mm.	2.49	95c C
29.1 mm.	1.98	95c B	42 mm.	2.49	95c C

NOTE: Type "A" mounts take 25 mm. filters; Type "B" 32 mm. and Type "C" 39 mm.

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COLOR	25 MM.	32 MM.	39 MM.
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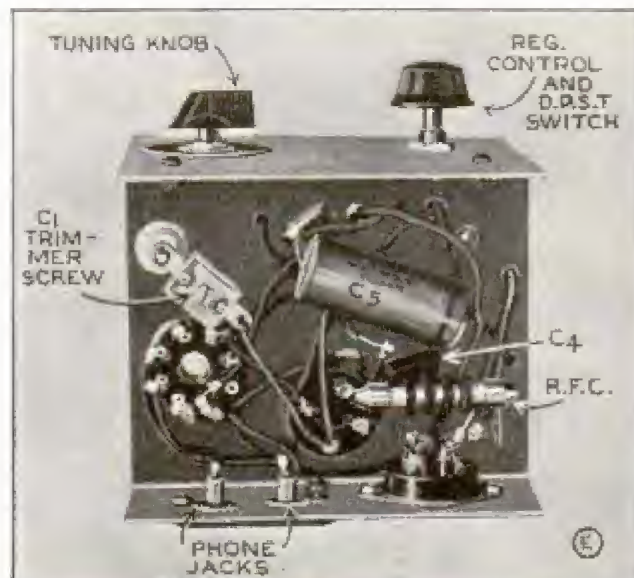
STATE.....

"Mighty Midget" One-Tuber

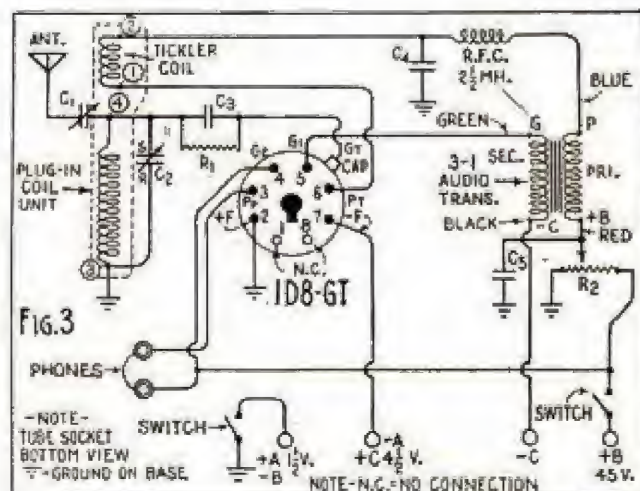
(Continued from page 137)

wire. A detailed material list is available from Popular Mechanics radio department without charge, if desired.

A high outdoor antenna, having an effective length of 90 feet, was used in original tests. No ground is necessary; however, a



ground wire can be connected under a chassis mounting nut if desired. Tuning is quite simple. Rotate the regeneration control until it is about two-thirds on, turn the variable condenser (C₂) until you pick up a whistle, then immediately "back off" the regeneration control until the station comes



in clear. Adjust trimmer condenser (C₁) for best results with each coil. Always use regeneration control carefully, especially with the smallest short-wave coils, as the set may howl if the control is advanced too far. Blueprint number for this article is R-280.

In Case of Fire

Continued from page 31

ground to jump without danger, wait for the firemen. They will get you down safely. If the wait seems too long, tie a rope of sheets or blankets to the bedpost, toss the other end out the window. Use this method of escape only when flames actually reach the room you are in.

Once outside the house, stay out. If someone needs to be rescued, tell the firemen. They know how to stay alive in smoke and fumes and superheated air.

If you must make your way through a smoke-filled room, forget the old wheeze



Towels will dry very quickly over the gas stove.
They will also burn quickly

about breathing through a wet towel or handkerchief. It has no effect on the fumes, which are the dangerous elements. Crawl along the floor, for smoke rises. In using a stairway, hug the wall. Don't take a deep breath unless you are absolutely sure that breath will see you through. For after holding your breath, your next several will be deep—you can't help it—and you will fill your lungs with toxic fumes. Do as the fireman does; breathe "from the top," taking short, shallow breaths. The retained air will prevent the fumes from entering deeply into your lungs.

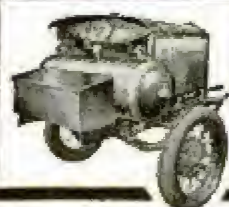
The really smart thing to do is not to have a fire. Most fires could be prevented by the simplest precautions. Hardly a night passes in my city that some person does not fall asleep smoking in bed. Dangerous business, this. Cotton and wool and feathers burn like tinder.

There is enough explosive power in a

(Continued to page 137A)

SAVE MONEY

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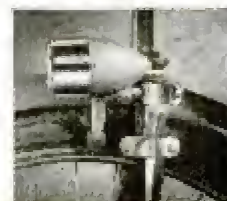
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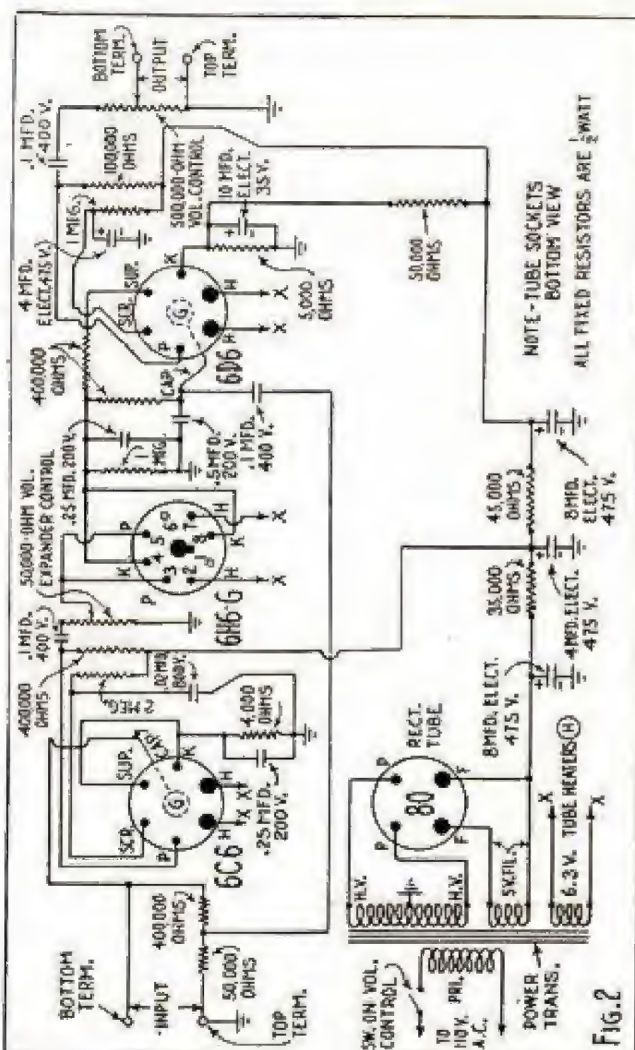
MASTER GLAZE CO., 7720-225 W. Harwood Ave., Milwaukee, Wis.

Volume Expander Unit

(Continued from page 138)

bar knobs, indicating plates, phono input jack strips, tubes and other parts plainly indicated in the photos.

To use the volume expander in connection with a phono pickup, connect the pickup (crystal or magnetic) to the "input" terminals. The output terminals of the expander unit are then connected to the regular phono input of the amplifier being



gallon of gasoline to send a one-ton automobile hurtling over the road at sixty miles an hour—for twenty miles. That's a lot more power than you'll find in a stick of dynamite. Yet a woman who would not think of having dynamite around the house will clean clothing in gasoline, while an open flame burns on the gas stove. A flame isn't necessary to cause an explosion. Sparks generated by rubbing wool or silk will do the job as thoroughly as the spark plugs of an automobile. Every year 2,500 amateur dry cleaners are killed by this method, as many more horribly burned. Yet non-inflammable carbon tetrachloride is cheaper than gasoline. Scarcely more excusable is the parent who leaves matches within reach of his child.

When an electric fuse burns out, that is a definite warning of an overload or short circuit—either condition a dangerous fire hazard. To replace that fuse with a penny is to remove a safety device that has just demonstrated its necessity; it is deliberately asking for a fire.

Thawing frozen water pipes with a blowtorch, candle, or flaming wad of paper is the cause of many fires. Another winter hazard is using pasteboard or wooden boxes as ash receptacles. Since the furnace is usually cleaned out at night, after which the family goes to bed, those hot ashes have a chance to start a brisk cellar blaze. Most of our winter night rescues from the upper floors of dwellings were necessary because of this dangerous practice.

The attic, another catch-all, is a danger spot in many homes. Mortar chips away between chimney bricks, accumulated soot burns, and sets fire to the inflammables stacked around the chimney in the attic.

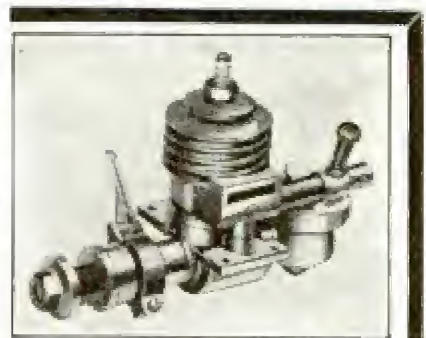
Searching in dark closets with a match has cost many a woman her life. Silk, wool, and cotton fabrics are highly inflammable, and smoke from the first two contain fatal quantities of hydrocyanic-acid gas, which is used to execute murderers in Nevada. Oily mops, or rags saturated with furniture polish, often ignite spontaneously, smolder for hours, then burst into flames as the closet door is opened.

Other homy hazards are forgotten electric irons, curtains blowing over an open-gas flame, or the drying of towels too near the stove or furnace. Most fires of this sort could be prevented by a little forethought.

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Complete
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with
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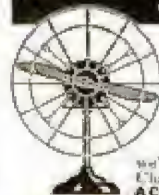


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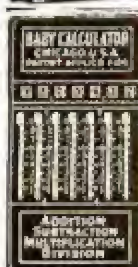
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CALCULATOR MACHINE CO., (Mfrs.) DEPT. 107, P.O. BOX 1118, CHICAGO, ILL.

Behind the Scenes in the Grain Pit

(Continued from page 37)

and each trader jots the figures on a card, one side of which is blue, representing purchases, the other side red, recording sales. On the blue face of his card your Quincy & Adams broker writes "5 SW," meaning 5,000 bushels September wheat; the name of the selling broker, the price, 97 $\frac{3}{8}$, and the number of your order.

If that price represented a change from the last transaction in wheat, a clerk in the "pulpit" at the side of the pit records the new price, time-stamps it, teletypes the quotation to the telegraph room from which it travels—along with the latest prices of corn, rye and other commodities—on ticker tape to brokers and trading halls throughout the country, and by Morse wires to the gallery of the Board of Trade where blackboard men chalk up the price changes under a long bank of fluorescent lamps.

Meanwhile, back to Quincy & Adams' Chicago office and thence to the Des Moines branch goes a confirmation of your purchase. It is clocked at "10 47 2"—the transaction completed in the pit in just fifty seconds. The two pit traders balance their accounts at the end of the day through the Board of Trade clearing house.

Now if you really want that wheat, wait until September and take delivery. The seller has the option of delivering wheat on futures contracts any day of the month specified. But probably you wouldn't have room in the house for 5,000 bushels, so on July 3 you take advantage of a price advance and phone Quincy & Adams to sell your contract at \$1.00 $\frac{3}{8}$, which would give you a profit of three cents a bushel, less commissions and any carrying charge on your account. Your sale order goes through the same routine. A final statement from your broker closes the transaction with a profit to your credit or something under \$150, and you never saw the wheat. Millions of bushels are traded in that manner at Chicago, Liverpool, Buenos Aires and Winnipeg and the other markets. In 1939 wheat futures trading at Chicago alone totaled 5,026,736,000 bushels while the domestic crop was 754,971,000 bushels.

Of course the Board of Trade doesn't live entirely in the future. Flanking the futures trading pits is a double row of ta-

K 172

bles laden with paper bags filled with samples of corn, oats, wheat, rye, beans. You see a man lift a bag to his nose, smell it, sift a few kernels through his fingers. He is a buyer from the Chicago Stockyards seeking high-grade feed for livestock. He smells samples of corn to detect a sour or musty odor, examines reports of inspectors who have graded it for weight per bushel, moisture content, etc. These are the cash tables, where actual grain just arrived by rail is bought and sold.

And back of this cash trade lie the invisible mechanics of the Board of Trade. Each sample bag on the cash tables represents a carload of grain waiting on the track for disposal. Each car is inspected upon arrival. In the railway yards state inspectors and Board of Trade samplers climb aboard, thrust long tubes down into the grain; perforations along the tubes open to let in samples from various levels of the car. If corn at the bottom is spoiled by moisture, that is discovered.

Samples are brought to the Board of Trade testing room. Let's take a sack of corn, for example. Its test weight per bushel is determined on the scales. Then two or three handfuls are fed between the electrode jaws of the moisture meter on which, after making corrections for temperature, the percentage of moisture in the kernels can be obtained. The grain is smelled for sweet, musty or sour condition. A rocky ride in a dockage machine separates the grain from dockage or foreign matter, and the percentage of weed and other seeds is determined by weight. Barley gets a special face-scraping operation that "pearls" off the hulls to discover any reddened by heat damage. Soybeans require a minute inspection by hand. After pouring the bagful through dividing funnels to get an accurate 200-gram cross-section, the inspector puts the sample through a sieve to sort out foreign material and split beans, then makes a bean-by-bean examination for splits, color, damage, etc.; a sound bean must be yellow inside.

So the grain flows, from farm to country elevator, to Chicago's grain market, sometimes 3,000 cars a day to be sampled, tested, sold over the cash tables of the 93-year-old Board of Trade and routed to millers, processors and livestock feeders or to giant elevators to await the demands of domestic trade or the bins of vessels bound overseas.



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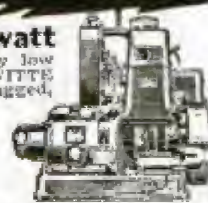
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Detour!—Bad Weather Aloft

(Continued from page 11)

greater efficiency of the weather bureau's reporting service. From twice to twenty-four times daily, detailed reports of weather conditions at hundreds of reporting stations are distributed over a network of telephone, telegraph, Teletype, and radio systems. Today's weather at Honolulu or at Kanaga in the Aleutian Islands is just as important to the air-line forecaster as reports from a few hundred miles away. Such reports consist of specific information on the state of weather, kinds and amounts



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of clouds, height of clouds, horizontal visibility, direction and force of the wind, temperature, dew-point, precipitation, and the barometric pressure and its direction and rate of change.

Information about upper-air conditions has been made more reliable by improvements to the "raob," the tiny robot weather stations attached to small balloons that radio weather statistics back to the earth as they ascend to 60,000 feet or more. These radiometeorographs now use electrical instruments instead of mechanical devices to determine temperature, humidity, and altitude. The electrical thermometer, for instance, consists of a column of salt solution instead of mercury, and the temperature is measured by the electrical resistance of the solution, which varies with temperature.

One thing the raob can't do yet is tell wind direction and speed. These data are gathered by observing the flight of a small pilot balloon by means of a theodolite, a method that is useful only until the balloon enters clouds or ascends out of sight

(Continued to page 142A)

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(Continued from page 141A)

at about 20,000 feet. To overcome this objection Luke C. L. Yuan and C. E. Miller of the California Institute of Technology are perfecting an ultra-high frequency radio direction finder by which the flight of the raob balloon can be followed. The direction finder is a selective radio compass that measures the horizontal and vertical angles to the tiny transmitter on the balloon and this information, together with the altitude, is used to tell the direction and velocity of wind at the balloon's altitude.

Experimental work is also being conducted on gathering upper-air information by measuring reflections of high-frequency radio signals. Such signals, reflected back to the earth by the upper-air layers, give some data on temperatures and humidities at extreme altitudes.

To some extent the current war has affected the regularity of air-line schedules. Some weather reports and forecasts are military secrets, and forecasters in the United States have been handicapped by reduced weather information from Canada. Ships of the belligerents hesitate to broadcast their weather for fear of giving away their positions, even on the Pacific. The result is that transoceanic airline pilots, unable to anticipate weather conditions ahead, have sometimes encountered head winds and have had to return. On the other hand, weather conditions off each seaboard are reported more completely than ever because of the broadcasts of naval vessels on coastwise patrol.

Robot weather stations at sea to augment ship reports have been suggested as a way to obtain more detailed information of marine conditions. One idea contemplates a system of anchored short-wave transmitters tuned to a frequency that does not readily pass through storms and large cloud masses. The location of storm areas and their speed and direction of travel might be learned by plotting the strength or weakness of the signals from each station. Another idea is to anchor robot radiometeorographs at points off shore to broadcast weather statistics as do the raob balloons. Wind chargers would replenish their batteries. A more immediate outcome of such suggestions may be the establishment of unattended radio weather robots in localities ashore not included in the present weather-reporting system.

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Sharpshooting at the Atom

(Continued from page 5)

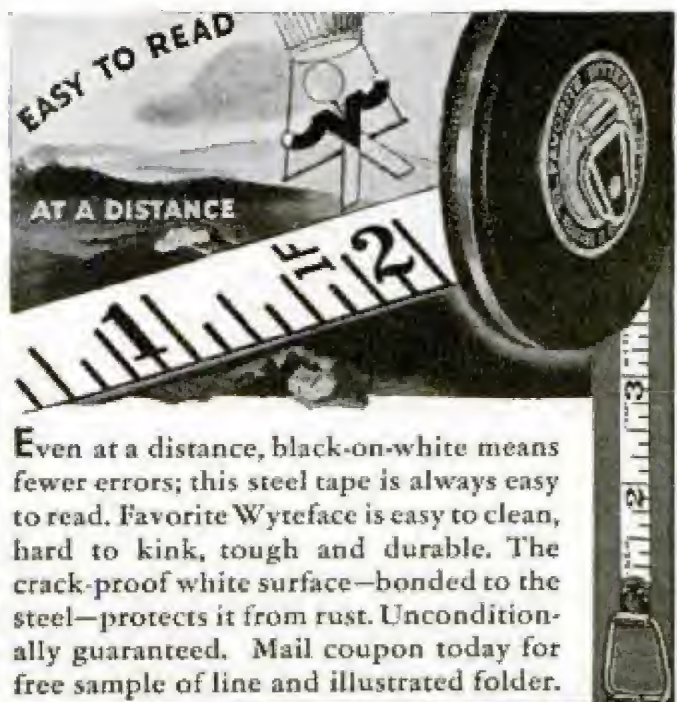
it goes to 4,000,000 volts—simply because it is harder for a spark to pass in compressed air than in ordinary air.

This high voltage is then applied to a vacuum tube extending from the high-voltage electrode to the bottom of the tank—more than thirty feet. In this tube the air density is only an infinitesimal fraction of that of ordinary air. The electrical projectiles gain speed as they rush down the tube to the bottom end where they strike the target to be bombarded.

At the target different things happen according to the case being studied. Some targets emit gamma rays, a form of very penetrating X-rays. Others emit neutrons which require special apparatus for their detection. Because neutrons can give a burn like X-rays it is necessary for the experimenters to be shielded very carefully during experiments. When properly used, beams of neutrons may become useful in treatment of cancer.

Another of the important tools used by the atom-smashing nuclear physicist is the mass spectrograph, or spectrometer. This is a device which makes it possible to sort out atoms differing in weight even though they are chemically identical. For example, there are two kinds of uranium atoms—one which is 235, the other 238 times as heavy as hydrogen. Recently it was discovered that when uranium is bombarded with neutrons some uranium atoms explode and the fragments have about 200,000,000 electron volts of energy—by far the largest amount released in any known nuclear process. This immediately revived the hope that this particular process might serve as a source of atomic power. It thus became important to know which kind of uranium is responsible for the energy release, and that called for separating the naturally occurring mixture. The task has been achieved very recently by Prof. A. O. Nier of the University of Minnesota who separated four micrograms with his mass spectrograph. He sent the separated material to Prof. John R. Dunning of Columbia University, who used neutrons from his cyclotron to establish the fact that it is the "235" kind that blows up when acted on by slow neutrons.

(Continued to page 144A)



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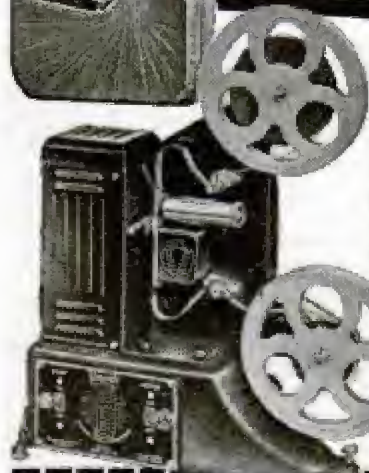
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Send illustrated booklet, which describes the new 1940 Univex 8mm. Movie Outfit and FREE \$3 Screen.

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(Continued from page 143A)

In the mass spectrograph a vacuum tube is placed in a strong magnetic field. In the tube electrons strike the molecules of the gas to be studied and ionize them; that is, knock one or more electrons off them. The ions now are speeded up by the action of an electric field. Since the same electric voltage acts on all of them, the fast ones are speeded up more than the slow ones. This happens in a small part of the tube. Then the magnetic field makes them move in circular paths, the fast ones moving in a circle of larger radius than the slow ones. In this way the ions of different weight are sorted out into different collectors.

Editor's Note—Discovery that "235" explodes with tremendous force, coupled with the feat of finding a way to separate the two kinds of uranium atoms, is regarded by some scientists as pointing the way to release of atomic power. Physicists assert that one pound of "235" would give off as much energy as 3,000,000 pounds of gasoline or 5,000,000 pounds of coal.

Professor Dunning, who discovered the explosive characteristics of the lighter uranium atom, is careful to state that one step remains before its use will become available to man—the improvement of methods of extracting it from ores. At present, it can be produced only in exceedingly small amounts. Uranium ore is available in large quantities.

Some scientists think that the discovery eventually may revolutionize the world, that it promises to make all other sources of power mere child's toys by comparison. They estimate that five to ten pounds of "235" would drive an ocean liner for an indefinite period; that as an explosive, one pound would generate a pressure about 1,000,000 times that produced by 15,000 tons of TNT; that a piece the size of a man's hand would enable a submarine to cross the Pacific ocean, and, that not much would be required to fly an airplane around the world.

It is pointed out that "235" can be made to give off its energy with surprising ease, simply by putting it into a tank and supplying a constant stream of cold water. The faster the cold water is fed in, the faster it comes out red hot on the other side, thus producing steam in any quantity desired.



"I CAN WHISTLE LOUDER THAN THIS HORN BLOWS"

Mr. White is a good-natured guy, but his horn has him down. "Here I pay extra dough to get a special horn that will really let 'em know I'm coming, and the darn thing sounds like a canary!"

So Fred gets out his voltmeter and checks the wiring in the horn circuit. "There's nothing wrong with that horn," he says, "but there's plenty wrong with this cable. It's too small for the load it has to carry."



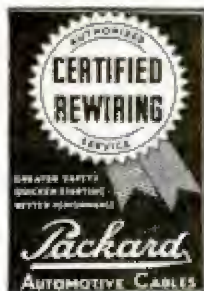
So Fred puts in some Packard cable of the right size, and the horn lets out a blast like a bugle. "Don't forget," he tells Mr. White, "good wiring is just as important to other electrical units, like your battery and headlights. Better let me give it a complete Certified Re-Wiring check-up."



GET RID OF ELECTRICAL "BOTTLE-NECKS" With PACKARD CERTIFIED RE-WIRING

Worn-out or undersize cables and faulty connections cause electrical "bottle-necks" that rob your car of pep, power and economy—and may result in serious damage to costly electrical units. Drive into a

Packard Certified Re-Wiring station and let a trained mechanic check your electrical system with accurate instruments. The blue-and-gold Certified Re-Wiring sign is your assurance that all faulty wiring will be traced down and replaced with Packard cable of the correct gauge.



DEALERS

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